Light and Lighting

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CONTENTS

	Page
Editorial	257
Notes and News	258
Home Lighting	261
Lighting the Television House, by Daphne Padell	263
Home Lighting Fittings, by A. D. Holmes	266
Wiring Installations Must be Adequate, by Phillip Honey	270
Three New Homes	272
Lighting Abstracts	276
Experiments in Side Street Lighting with a Scale Model, by G. M. Dorey	277
Prescribing for Seeing, by M. L. Berson	287
Correspondence	
The I.E.S. Code (John Bickerdike)	
Office Lighting (R. R. Holmes)	290
Postscript, by "Lumeritas"	292

Home Lighting

MANY homes in all countries have bad or indifferent lighting and, in the view of the International Illumination Commission, recently expressed at Zurich, the improvement of lighting in homes should be actively promoted by all appropriate means. One means of promoting better home lighting is, of course, popular education in the principles which must be applied if good home lighting is to be obtained. The extension of such education was also recommended at Zurich, and one valuable way of doing this—namely by popular lectures to schoolchildren—has been followed by the I.E.S. in this country for some years past. It is also important that recommendations for home lighting should be in terms which the ordinary householder can understand. It is not of much use to tell him he should have so many lumens per square foot in this room or that, but much better to tell him the wattage of the lamps he must have in the kind of fittings he is likely to use if he is to have sufficient illumination for various home uses. Articles on home lighting are not infrequently published in the popular Press and instruction has also been given by radio and television. All this is to the good provided the information is given by suitably knowledgeable people.

Notes and News

"H55" Halsingborg

Any complacency that British architects may feel regarding our post-war efforts in house design is liable to be dispelled by the "H55" international exhibition of architecture, industrial design, home furnishing and crafts, which opened recently at Halsingborg, Sweden.

Not that the British contribution to the exhibition —a flat designed by Eric Lyons, F.R.I.B.A., M.S.I.A., and furnished for the Council of Industrial Design by Jo Pattrick*—is in any way inferior to those from the other countries taking part (it is, on the contrary, one of the most successful exhibits, and it is reported that it has attracted more attention than any other), but certain nations, particularly the Japanese and the Swedish, seem to get their effects with far less conscious effort.

The Japanese flat, for example, has a sense of spaciousness and repose which clearly springs from a long tradition of design in one idiom—an idiom, incidentally, with which our somewhat self-conscious contemporary style has much in common. It all seems to come much easier to the Swedes, too, for they are working with indigenous motifs, whereas British designers, in spite of the excellence of many of their end products, are still mostly drawing their inspiration from the culture of other lands.

The British flat at the "H55" exhibition was organised by C.O.I.D., on behalf of a group of private subscribers.

Italian Design

To a greater extent than at any other time since the renaissance, designers in all branches of the visual arts are turning towards Italy for their inspiration and guidance. If the twenties (the era of the Bauhaus) belonged to Germany and the thirties and the early post-war years to Scandinavia, there is little doubt that the fifties belong to Italy. In one industry after another, from cars to *couture*, Italian designers have taken the world lead.

Timely, therefore, was the exhibition of Italian industrial art held last month at the Italian Institute in London. This was a small but select show, comprising no more than 33 exhibits, each carefully chosen with the following criteria in mind :—

"The relevance of the form to the function;

"The absence of any arbitrary decoration;

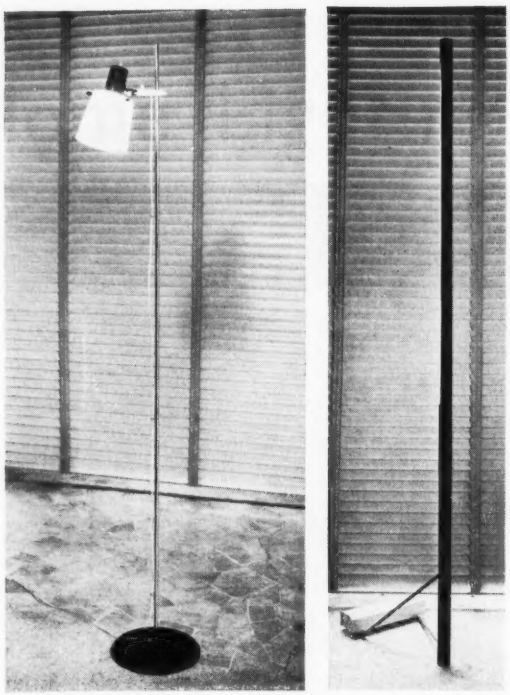
"An approach to design which is in harmony with the present tendencies in graphic and visual art."

The exhibits ranged from components for the latest Fiat cars to leather travelling bags, and included several lighting fittings, two of which are illustrated here. One of these is a fluorescent standard lamp. It comprises a plain metal tube containing the lamp, with the control unit attached to the simple base. It is intended, of course, for indirect lighting, as in the photograph, where it shines on a Venetian blind.

The other lighting fitting illustrated is a multi-

* The flat itself is a replica of one of the flats at Ham Common and Blackheath, an example of which is illustrated on p. 260 and pp. 273-4.

British show-flat at Halsingborg. *Reproduced by permission of the Council of Industrial Design.*

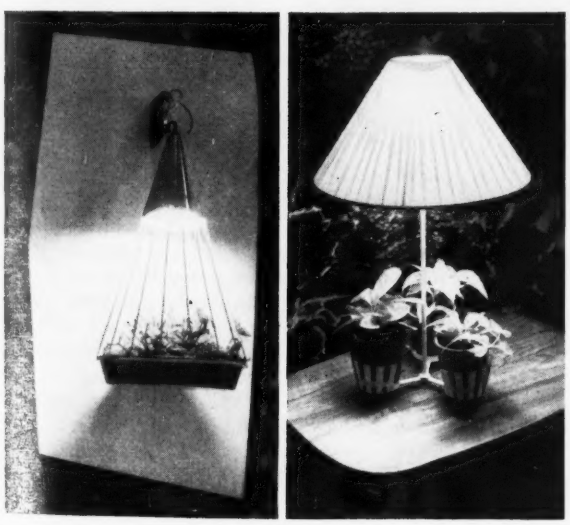


purpose fitting which is purchased unassembled in nine component parts. These can be put together in various ways to form 10 different fittings. (Both fittings were designed by Gino Sarfatti.)

Plants and Lights

A new idea in lighting fittings, particularly suitable for home lighting—the theme of this issue of *Light and Lighting*—has been launched by Siemens. To be known as Fleurlite, this is a range of wall lights and table lamps which serve also as holders for pots of indoor plants.

It is the colour and natural form of indoor plants that so often saves the contemporary interior from being cold and austere, and the idea of combining receptacles for indoor plants with lighting fittings is most appropriate, particularly now that pendant fittings are going out of fashion and more and more wall lights and table lamps are in demand.



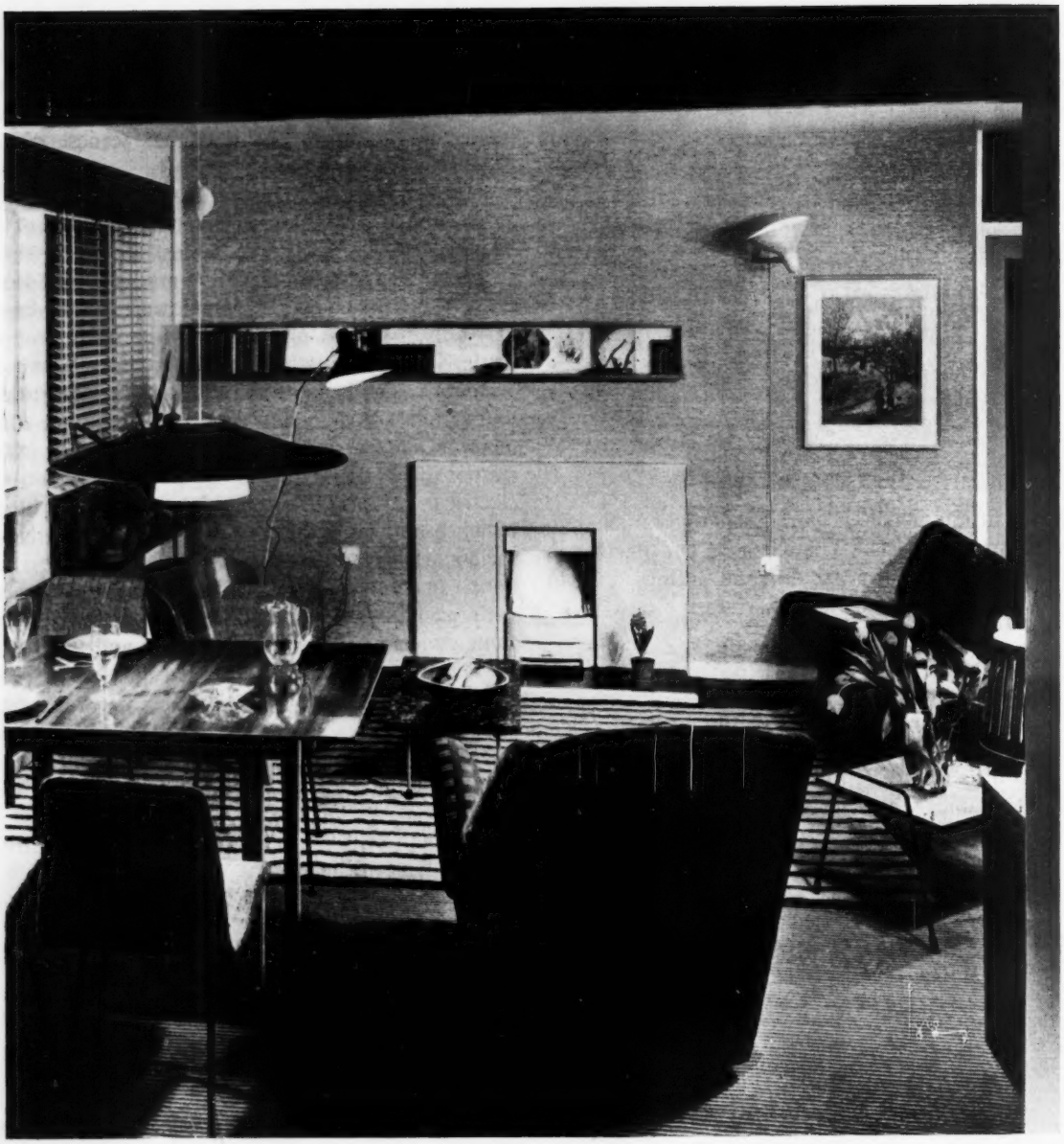
Testing and Research

The I.E.S. visit on July 8 to the E.D.A. Testing House and the C.E.A. Research Laboratories, apart from being a very pleasant outing, provided some interesting glimpses behind the scenes of the Electricity Supply Industry.

The success of the Testing House visit, in the eyes of the ladies, was assured by the assertion of the manager that the only way to test a cooker was to cook with it, and by the resulting production of scones cooked to a nicety. The great care taken to ensure that only first-class products are approved was particularly evident in the X-ray laboratory where not even embedded heater elements could escape ruthless inquisition. It does not appear that lighting equipment is classed as domestic equipment for testing purposes; no doubt this is understandable since the electrical performance and safety of lighting fittings tends to be overshadowed by other features. Nevertheless, the present-day rash of all-metal portable lamps, many devoid of earthing facilities and designed with scant regard to heat dissipation, is a cause of some concern to the supply industry and the Testing House approach to other electrical items in the home would not be inappropriate to them. It was refreshing to note the excellent, and beautifully maintained, lighting installation, particularly the use of louvred industrial fluorescent trough fittings in the main laboratories.

The parallel visit to the C.E.A. Research Laboratories was no less revealing in many ways. We were impressed by the complexities involved in the exchange of electrical power with Continental Europe, certainly one had not thought about using an electronic computor to summate the instantaneous heating of the cross-Channel cable and thus to eliminate a wasteful heating safety factor. Nor did we appreciate until our visit, that one necessary outcome of the proposed cross-Channel connection would be automatic frequency control involving a nation-wide hook-up in place of our present system of manual corrections to frequency carried out overnight.

The C.E.A.'s interest in lighting matters was revealed by ingenious apparatus for recording daylighting levels which has been developed in consequence of the enormous load variation caused by fluctuations in daylight illumination. The results of this survey will be most valuable to the lighting world generally and it will be interesting to see how they compare with the well-known N.P.L. daylight tables.



Living-room of the demonstration flat at Blackheath, designed by Eric Lyons.

Home Lighting

A discussion, arranged by the I.E.S., between

Miss Daphne Padell and Mr. J. D. G. Bodart—users

Mr. Paul Reilly—designer

Mr. E. B. Sawyer—lighting engineer

In his introductory remarks the chairman (Mr. W. R. Stevens) recalled a previous informal meeting on home lighting two or three years ago, and the paper by Young and Misselbrook at the 1954 Summer Meeting; in spite of these previous meetings, however, there was still plenty to say on the subject, whilst the need to improve lighting in the home was as great as ever.

Mr. Sawyer, opening the discussion as a lighting engineer, said that there was hardly any engineering about home lighting which was so much a matter of taste that no two people seemed to agree on how to light any particular room. Few people have any idea what sort of lighting they want in their homes, and even when they have made up their minds the chances are that the electrical installation will be inadequate. On the question of wiring, he deplored a recent Government publication on the quicker completion of homes, which recommended that the number of electrical outlets be reduced to a minimum; all housewives, he said, want a generous number of outlets, competently wired and switched. He pointed out that the cost at the time of building of providing additional points where they are required is very small.

Turning to the lighting of different parts of a house, Mr. Sawyer made the following points: a light in the front porch and at the back door is a help not only to the people living in the house but also to visitors; in the kitchen there should be a good basic light with additional lighting for the sink and work areas; lighting in the vicinity of mirrors should be arranged to throw light on to the person, not on the mirror. The actual levels of illumination, he thought, were not important; sufficient light should be provided to enable movement in safety and comfort, with additional lighting for particular purposes such as reading, sewing, etc.

Referring to fluorescent lighting, he said that it was most important to choose the right colour of lamp. A lot of nonsense was spoken by the uninformed on so-called harmful effects of fluorescent lighting.

Miss Daphne Padell then described, with slides, the lighting in a new house (described in detail on pp. 263-5) which she and her husband, Mr. J. D. G. Bodart, had recently had built. The new house, she said, had been built on the site of an older house, which they had demolished.

The next speaker, Mr. Paul Reilly, Deputy Director of the Council of Industrial Design, remarked on the change of taste which has taken place in post-war years, particularly in the lighting industry. This had been a backward industry for years but since the war there has been such development that there is now an almost embarrassing choice of designs. No longer must you have the "frosted football"; you can get lights of all descriptions to-day which fit very elegantly into modern homes and now you can mix modern wallpapers, lighting fittings and period furniture.

A few years ago the designs were the traditional forms of the gas industry or even earlier, but not one of these has appeared in Miss Padell's house. Mr. Reilly said he considered that this change in the industry was one of the most heartening things for the interior designer to-day because he need not any longer rely on antiques—he could choose something which has been designed for a modern home. This change of taste, he said, had interested him for a long while; he had always been interested in modern design and before the war had tried to live "up to date" with square, spare modern furniture, plain walls, "frosted footballs," etc. He liked to think he had a "contemporary" eye and is glad to find that the kind of home he would like to-day is colourful and gay.

These changes in taste seem to develop in three stages; a style will start plain, simple, spare; then it will develop to be more elegant and decorative and then become rather theatrical, as at the end of the Victorian period. To-day the modern movement seems to be developing from stage 1 to stage 2 and we are now in the middle phase of taste: pretty, elegant, light, decorative. Probably we will live to see the wheel move still further and once again have an over-brilliant, over-lush style of design. The great thing is that if it does happen again and the lighting industry carries on as it is to-day employing designers who are qualified men of vision and taste, there will be a much better end to the circle than at the end of Victorian times.

Mr. Reilly said he felt that the lighting industry, after a very slow start, is now well in the vanguard of the modern movement in interior design, and he stressed that fashion is essential in any period of design. Lighting is becoming a fashion industry and he said that it was up to the companies making lighting fittings to see that "fashion" does not deteriorate into something which in a few years' time will be looked upon with derision and

distaste; he felt, however, that this was unlikely to happen because there are a number of very good young designers in the industry. He said that personally he felt optimistic that we shall go on with contemporary lighting for the contemporary home whatever the developments of the design of the home.

After the opening contributions by the members of the panel the discussion was taken up by members of the audience. The first speaker was Mr. W. Robinson, who pointed out that there are some 13 million homes in this country with an electricity supply which is used mainly for lighting. The average householder spends 30s. a year on lighting—less than he spends on window cleaning. Three hundred thousand new homes are being built every year—nearly all of them being wired with central ceiling lighting points. Mr. Robinson thought that the lighting engineer was largely responsible for this lack of imagination by architects and users; the lighting industry needed a new approach to the question of home lighting based on the needs of the average householder, not, as one was led to believe, from the glossy magazines on expensive houses and flats, which bore no relation whatsoever to the average home.

Dealing with lighting fittings, Mr. Robinson said that the C.O.I.D. had done a very good job, and he hoped they would keep it up; he wished, however, that more fittings designers would remember that the purpose of lighting fittings was to let light out and not "to wrap it up like a bundle of fish and chips."

Taking up Mr. Sawyer's point about adequate wiring and outlets, he said architects, builders and local authorities should be urged to spend a little more to install ring main circuits; it did not seem to occur to builders of houses that it is too late to install a ring main after a house is completed. Architects should be educated in the virtues of these circuits. Whilst mentioning architects Mr. Robinson said he would like to see them placing their lighting points with the same care as they site the water supply—"no architect would think of placing the water taps in the centre of the ceiling and squirting the water to where it is required."

Mr. Bodart said that his new house was only 958 sq. ft. in area and was therefore quite a small one (less than many council houses), even though it had been featured in a glossy magazine. The lighting had been inexpensive and had been chosen according to their own tastes and to fit in with the general scheme of decoration. Lighting fittings, he thought, should be chosen with the same care as the furnishings; their own lighting, simple though it was, has called forth much comment from visitors, who had seemed surprised that good lighting fittings were made and were obtainable in this country. He thought that the industry had been rather backward in making this known, particularly as there appeared to be many people who wanted such fittings and thought they were obtainable only in other countries or at great expense.

Paul Reilly spoke in defence of the glossy magazines; they were, he said, much better informed on good design than they were a few years ago, and instead of being out of touch with reality, he thought that they were a good influence in educating their readers to demand articles of good design and performance.

Mr. Don Allom said that his main interest in home lighting was in providing good lighting for people who already have comfortable homes rather than in lighting new homes. He had come to the conclusion that the only satisfactory background lighting in living-rooms was indirect lighting on which could be superimposed accent lighting for special purposes or decorative lighting. Referring to the Bodart home he thought that the swinging lamp in the living-room would be very glaring to people sitting around the fire.

Mr. Bodart and Miss Padell denied that the swinging lamp caused glare. They also said that the next stage in the lighting of their living-room included indirect lighting along the window wall. Mr. Bodart added that indirect lighting alone was dull, cold and expensive and would tend to make a living-room "look like a waiting-room at an airport."

Mrs. Penny thought it wrong to decorate and furnish a room before thinking of the lighting; in fact she preferred to be able to see first and decorate afterwards. She showed a number of coloured slides. She also said that people should be careful to choose lighting suitable for their type of home and not try to be pretentious.

Mrs. Sawyer said that in her opinion portable lamps were essential but trailing flex was always a nuisance. She asked whether it was possible to incorporate some arrangement in the base of such lamps so that the flex was wound in or out on a spring as the lamp was moved about. She also thought that shuttered socket outlets should be made compulsory. On the matter of fittings she said that quality was improving but there were still far too many shoddy fittings on the market.

Mr. Sawyer said that the masses of cheap fittings on the market were intended for poorer people, though unfortunately they were just the people who could not afford to waste money on such stuff. He thought that it was up to reputable manufacturers to produce cheap good quality fittings. He recalled that Paul Reilly had mentioned fashion in lighting; this he thought was a good thing and suggested that housewives might change their lighting fittings just as they change their curtains or move around the furniture, though to enable them to do this the fittings should be made more easily changeable.

Mr. John Reid, an architect, said that he was now building a house in which the client had asked for an abundance of socket outlets, all of which were being installed. The lighting scheme adopted was indirect lighting to give low level general illumination (which he agreed, used on its own, would be dull—as dull as an overcast sky) with a large number of additional lighting points to light particular places and features about the house. Where houses are specially built, he said, it was easy enough to agree on the number of points and their positions; with the speculation built house or the council-type house, where all the houses are alike and the cost is kept low, as a rule only one lighting point is provided per room, and as the architect does not know how the rooms will be used (as he does with a private client) he has no alternative but to place the lighting point in the centre of the ceiling.

On the subject of contemporary design fittings, Mr. Reid said that these could be obtained quite cheaply and could be used in the cheapest houses. He said that people who wanted to use good contemporary design did not need to have plenty of money to spend; all they needed was to give the matter a little thought.

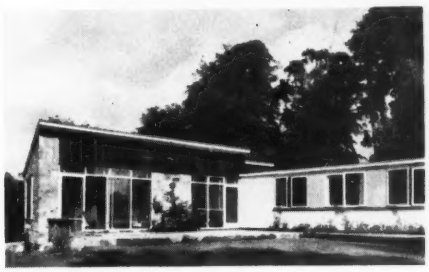
Other speakers in the discussion mentioned the importance of throwing light on to the walls of a room,

and the noise of fluorescent lamp control gear, which could be disturbing, particularly when trying to get children to sleep.

In the final comments from members of the panel, Miss Padell said that she thought fluorescent lighting unbecoming in the home, and Mr. Reilly endorsed Mrs. Penny's remarks about home lighting being unpretentious.

Summing up the discussion, Mr. Stevens said that it was only too obvious that no two people thought alike on the subject of home lighting—some liked indirect lighting, others direct lighting; some abhorred the very presence of wires, whilst others seemed to like veritable "cats' cradles." The word "fashion" had cropped up several times in the discussion—all we can say is that fashion changes, and at this present time the fashion is whatever it is; in a generation or two people may even think our present ideas rather odd.

Lighting the Television House



By Daphne Padell

A description of the lighting in the author's new house, the building and equipping of which was featured on television.

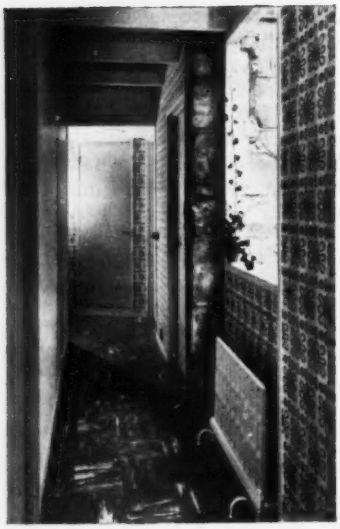
Living-room.

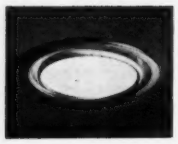
Dining-room.

When we started to plan the lighting of our new house we began to take a more than ordinary interest in other people's ideas on the subject. We came to the conclusion that in most homes lighting was an afterthought, or no thought at all, just a necessity, dismissed with as little expenditure of time and planning as possible, and no consideration for aesthetic values. With one or two exceptions, most homes had ordinary or old-fashioned standard lamps, and a strange assortment of gruesome shades bearing no relation to the scheme of the room. Some people seemed happy enough to dispel darkness with a naked bulb.

But if homes were uninspiring, many show rooms and certain exhibitions were very stimulating. We soon discovered there was plenty of good, contemporary lighting equipment to be had if you went out to look for it.

We feel light is infinitely important, and to capture as much daylight and sunshine as we can, the house has been designed with enormous windows. No reason then, to lose this brilliance at



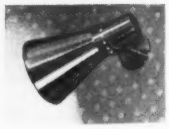


Corridor.

Main bedroom.

Guest room.

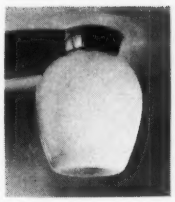
Boys' room.

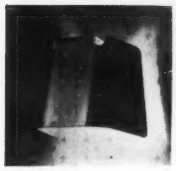


night, though I think the occasional dark corner is an attractive foil to the bright lights elsewhere in a room.

To be practical then; we planned our lighting installations and equipment for three stages, governed by time and by financial circumstances. The first stage—to meet immediate requirements with as strong a relationship to the decor of each room as we could afford: the second stage—to add indirect and concealed lighting, including special arrangements for lighting my dressing-table, etc.: the third stage—the outside lighting, on the terrace, down the drive, and around the old cobbled courtyard. Only the first stage has been completed so far.

One wing of the house consists of a big living-room, 30 ft. by 13 ft., with a dining recess at one end. Here we have a fine swinging lamp with a vast parchment coolie hat type of shade. Aluminium tubing takes it up beside the fireplace and then turns out at right angles for a further 3 ft. or so, swinging out over the hearth so that everyone sitting round the fire has adequate light. It has all the





Kitchen.

advantages of the standard lamp but it cannot trip you up, nor can it be toppled over.

The white metal shade for the main light at the dining-room end is austere in line, but highly practical as it is adjustable and can be focused on to the table, or downwards on to the oak chest for carving. We did not want the lamp here to be too elaborate ; the antique gilt mirror and the old oak chest, against the cherry red wall show to their best advantage in the contemporary room with just this clear-cut light on them. The rest of the lights for this room will come in stage two, when we install a strip of indirect lighting along the south wall between the big windows. It will be concealed by the Quill Venetian blinds.

The corridor joining the living-room with the rest of the house is most attractive, with pink, white, grey and plum wallpaper along one wall, white paint and pink doors for the other wall. There we have fixed a flat ceiling light at the turn of the corridor. With little extra head-room at this point we had to have something flush with the ceiling. (It was a tricky job to fix, and my husband got his head stuck in the space prepared for the lamp!) But we are delighted with its appearance, and it gives excellent light, especially to the linen cupboard just beneath it.

This pink, white, grey and plum paper continues on into the main bedroom along one wall, with deep plum paper on the centre panel of the ceiling and in the alcove of the bed. The lamp above my dressing-table, an old spinet awaiting conversion and which will have its own particular lighting system, is white, stiffly starched and pleated—(known to us as the Melton Mowbray pie frill). It is attached to the ceiling with a white metal fitment and gives a very adequate light. On each side of the bed we have our own individual lamps like little metal megaphones, adjustable so that you can focus on a book but away from the other person's eyes if one wants to read and the other wants to sleep. They are very attractive, and here again you have the advantage that they are fixed to the bed—no knocking lamps off side tables. We have two more megaphone lamps on each bunk in the boys' room. This time the metal is enamelled cherry red on the outside, picking up the red piping on the white piqué bunk covers. The colours in this room are red, white and grey. The boys also have a contemporary hanging lamp with a coolie hat shade over the dressing-table.

The guest room, with its brilliant green leaf wallpaper alternating with bamboo paper on adjacent walls, is an admirable setting for a beautifully designed table lamp ; a pleated shade, with an upturned glass cone, standing on three fine legs, and somehow managing to look like some tropical animal, or is it the effect of the bamboo and south sea island leaves ? The same theme is picked up by the shade of the hanging lamp. This room is brilliantly fresh and bright both in daylight and at night.

The working part of the house has practical, easy-to-clean fitments, but attractive and of contemporary design. The centre light in the kitchen is like an upturned balloon brandy glass, and the one above the breakfast corner is made of pierced aluminium and looks exactly like a welder's mask ! My cooker has a special light all of its own, so altogether there is no vestige of a dark corner in the kitchen.

The bathroom, with its walls of yellow Vitrolite and mirror, has a clean cut yellow enamelled metal light fitment from the ceiling. It has small perforated holes as its only decoration, and we have one exactly like it but in red in the lavatory, which has very amusing red and white wallpaper.

Soon we hope to start on the second stage of our lighting scheme, indirect lighting and lights for cupboards that turn on automatically when you open the doors . . . but this must wait.

Home Lighting Fittings

By A. D. HOLMES,
Manager, Electrical Dept.,
Heal & Son, Ltd.

Why are the new designs of light fittings proving to be so immensely popular? The answer to this is undoubtedly that present-day designers are using their imagination and creating fittings that are efficient without being ugly, and decorative through the intelligent use of the correct medium, with plenty of scope for colour.

Our designers have also appreciated the fact that whilst the majority of the general public have realised the importance of having light in the right place, this point has often been completely overlooked by the architect or builder, so that in consequence there is a large demand for adjustable fittings.

The range of designs now on the market is so vast that no architect, interior decorator or salesman should experience any great difficulty in satisfying even the most exacting customer.

An analysis of the buying public is, of course, the only method of proving in a constructive manner how well our designers are doing their job.

As I see it, the public with whom the designers have to contend can be divided into four main groups, *viz.*, those requiring fittings (a) to

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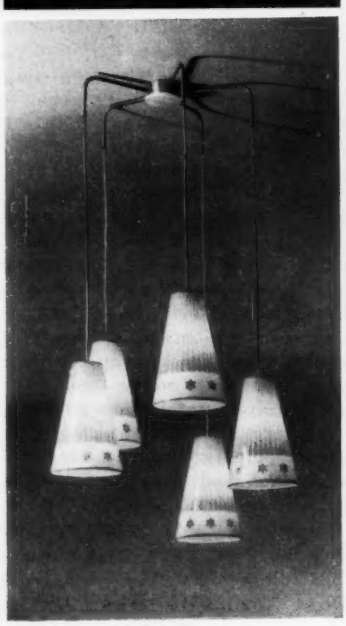

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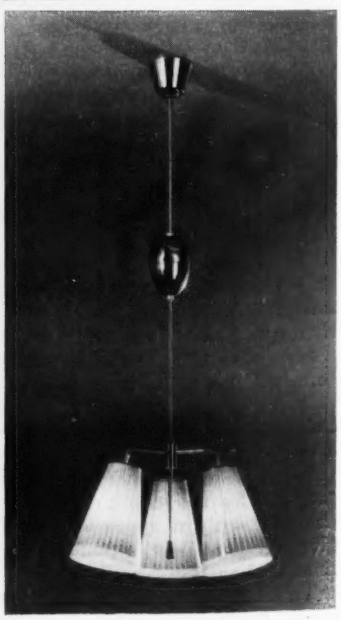

1. *Centre light with exceptionally clean lines by Fred Thomas, designed in conjunction with Heal & Son, Ltd.*
2. *Inexpensive centre light by Falk, Stadelmann & Co., Ltd.*
3. *A fitting which can easily be used to replace an old fitting and give life to a decor. (G.E.C. Ltd.)*
4. *Rise and fall fitting. (G.E.C. Ltd.)*

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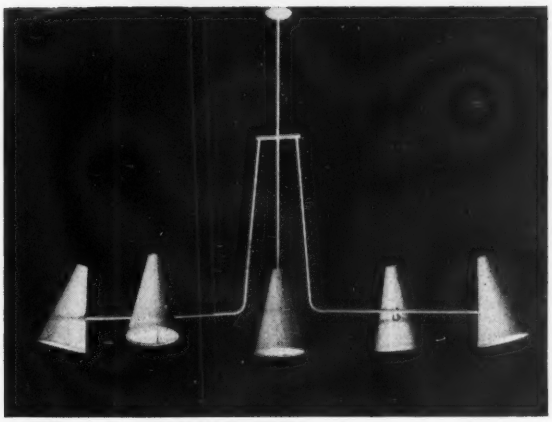

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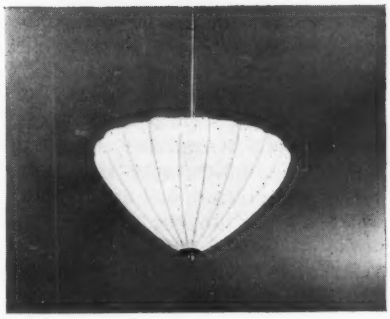

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replace old fittings, (b) when moving to a new house, (c) when starting afresh (new furnishings), or (d) when setting up house.

All of these can be sub-divided into what I term the (i) "Unfortunate necessity" type, (ii) "The something new" type, (iii) "The I must see" type. I will endeavour to deal with all categories.

New fittings to replace old

The "unfortunate necessity" customers are either the most difficult or the easiest to satisfy, and in either case the least interesting, for they invariably require either a repeat of an old and probably obsolete design, or they don't care so long as the price is right. What they buy depends very much on the guidance they receive, and with them there is a great temptation for the unscrupulous salesman to unload his old stock, whether it is suitable or not. This is a pity when you consider how many good and inexpensive designs are on the market. Figures 1 and 2 show good examples of centre lights particularly suitable for these people.

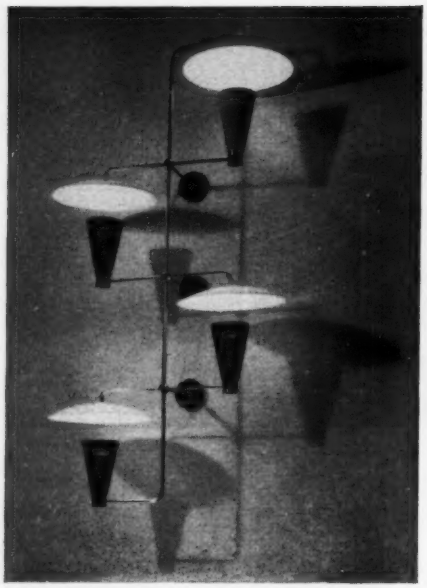
The "something new" customers are usually the most frustrated as they find it difficult to combine the new with the old, and in consequence the help of their adviser so often results in the "special" which is the curse of the manufacturer, and is so seldom the great success that its preparation warrants. Figures 3 and 4 are two of many designs which might interest this category.

The "I want to see" customer is nearest to my heart and has my profound sympathy and respect. I am thinking, of course, of the man who has purchased the finest examples of the lampmaker's art, put them in his fittings and then had their efficiency reduced to about 40 per cent. by stupid little dark lamp shades. He is now determined that such a mistake is not going to happen again, and such obviously right thinking makes him careful in his selection and helps to create a demand for efficiency. Figures 5 and 6 are the result of the designers thinking on the same lines. They are both examples of lighting for dining tables and are adjustable to give a degree of indirect light, or to spotlight some particular feature of the room.

Moving to a different house

The "unfortunate necessity" customers are again either very easy or very difficult, and more often

5. *Dining table fitting. Designed by J. C. Heal and made by Oswald Hollman for Heal & Son, Ltd.*
6. *Dining table fitting by Francis Mackmin Ltd., for Heal & Son, Ltd.*
7. *Inexpensive and practical shade by H. C. Hiscock, Ltd.*
8. *Chrysaline shade by G.E.C. Ltd. An easy solution to a difficult problem.*



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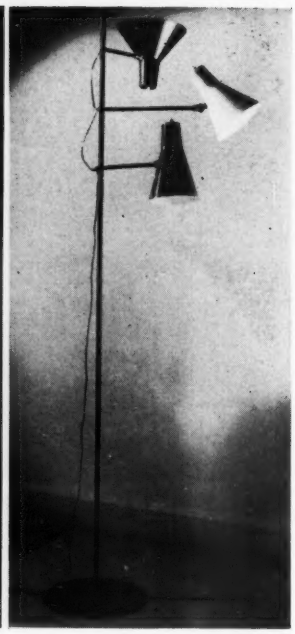

10, 11

come into the latter category as they are only buying new fittings because the old are unsuitable or because they have a greater number of rooms to furnish. As price is usually an important factor, these people more often than not purchase lampshades such as the well-known Multiray and Chrysaline shades (Figs. 7 and 8), which are particularly suitable.

The " something new " customers are probably the largest section, and according to the advice they receive, their homes become interesting or merely a novelty of which they soon become tired. Given the right setting, fittings of the type shown in Fig. 9 give pleasure and a feeling of well-being to anyone entering a house.

For the " I want to see " customer either of the two adjustable floor standards shown in Figs. 10 and 11, which will give him light wherever he needs it; these two fittings are, in my opinion, two of the finest examples of the designer tackling the problem of how to light a room from an inadequate number of points.

Starting afresh

Here again the " unfortunate necessity " customers are in most part easy to satisfy from the enormous range available, and are only concerned with price. Where they buy and what they buy is usually a matter of convenience and the only way to be certain that they purchase fittings of good design would be to see that the retailers had nothing else. Unfortunately this is far from being the case.

The " something new " customer is in this case the delight of the salesman for this is the chance to see that latest design so often without the restriction of price. Fig. 12 shows one of the fittings so popular and so suitable for these people.

The " I want to see " customer is mainly concerned with efficiency, and if he should happen to be a person who understands a little about production in the factory, the workshop or the office, and appreciates what a vital factor good lighting is, he will probably require the same perfection in his home.

Setting up house

The " unfortunate necessity " customers buy their fittings somewhere. It is not, however, very difficult to persuade them to have a delightful pendant (Fig. 13) instead of the ghastly coloured imitation alabaster bowl that still seems to be so popular.

The " something new " customers make the most mistakes, so often selecting sensational, or what they

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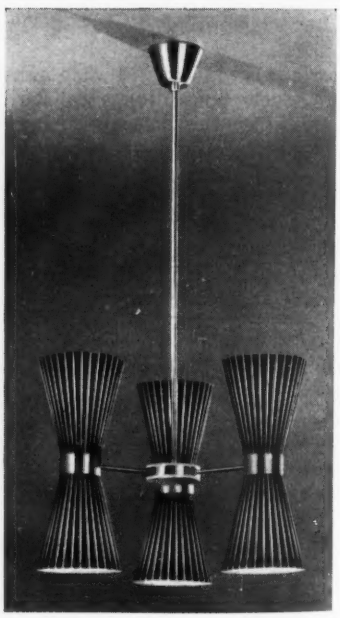
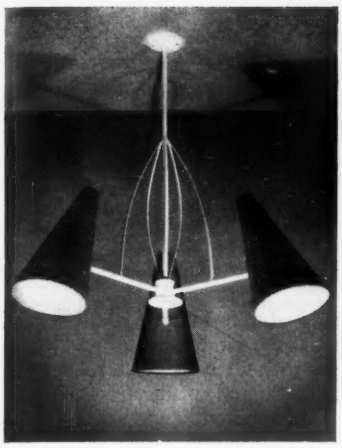


9. *Delightful design by John Barnicott of Falk, Stadelmann & Co., Ltd.*

10. *Floor standard by Hiscock, Appleby & Co.: reading light, indirect light and spotlight from one fitting.*

11. *Floor standard by Bernard Schottlander. Simplicity of form with infinite adaptability and scope for colour.*

12. *A good example of an elegant modern fitting. (G.E.C. Ltd.)*



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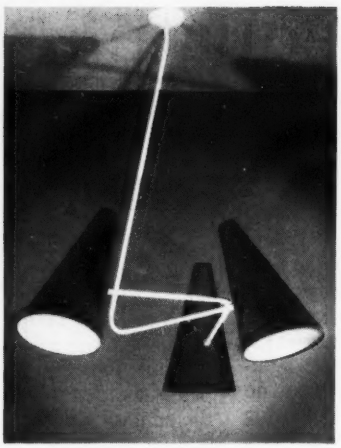

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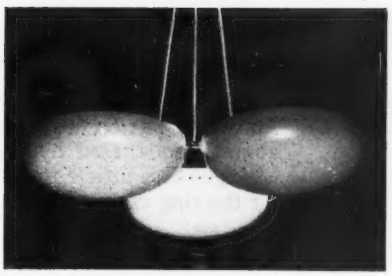

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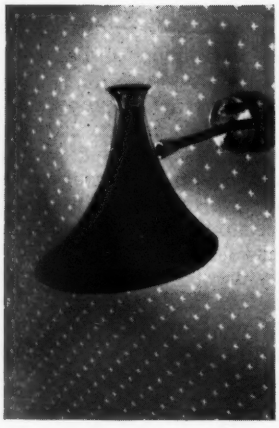

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13 *Centre light by Osler and Faraday. A new conception of an old idea.*

14. *Centre light by Francis Mackmin, Ltd.; gay without being frivolous.*

15. *Centre light by Francis Mackmin, Ltd. An asymmetric design which has to be used with care, though its lightness makes it suitable for use in small rooms.*

16 *Wall light by Hiscock, Appleby & Co.: a logical shape, good to look at and giving a good spread of light.*

17. *Centre light by Hiscock, Appleby & Co. for Heal & Son, Ltd. Gives direct and indirect lighting with an interesting high-light and shadow effect.*

consider to be fashionable, designs without due thought to the fact that they will have to live with them for a long time. These people should be encouraged, but carefully guided. Restrained designs (Figs. 14 and 15) in the right colours, or wall brackets (Fig. 16) should give them the interest they require and should continue to give them pleasure for a long time to come.

The " I want to see " customers are the persons for whom there is the widest choice and their advisers to-day have tremendous scope. Fig. 17 shows a delightfully simple pendant fitting giving both direct and indirect light, with a wonderful opportunity of using a combination of two good colours. There are so many good modern fittings suitable for this large section of the buying public that one cannot doubt the wisdom of some of our biggest light-fittings manufacturers in devoting whole showrooms to " modern " fittings.

There is one further category—those who have had their lighting designed with the house, which is, of course, the intelligent and only completely satisfactory method. For those and for their architects, lighting is a simple matter, but I do appeal to both architects and builders to consider the housewife at the sink with her back to the light, the dining table that is not used in the centre of the room, and the landing light which so often leaves half the staircase in semi-darkness.

Our designers have overcome all these problems but it would be so much better if the difficulties were not created in the first place.

Wiring Installations Must be Adequate

Too often better lighting in the home is hampered by inadequate wiring. This article states the case for the ring circuit.

By PHILIP HONEY, A.M.I.E.E.

Recent trends in domestic electric lighting show quite clearly that there is much more in its application than there used to be. Ceiling points and wall brackets, which have been with us since the earliest days of electric lighting, do not go well with contemporary furnishing, nor do they provide the contrasts in light, shade and colouring which are demanded to-day. Fixed lighting points are, in fact, a relic of gas-lighting days. They have their uses, but they cannot be changed in design or position without a major upheaval.

A room lit by a number of movable lamps gains considerably in its charm and atmosphere, as most architects and lighting experts know, but how can one indulge one's fancies in this direction if there are only two plug-points in a room, one, say, of 15 amperes capacity, which will no doubt be fully occupied in supplying an electric fire, and another of two or five amperes capacity, which will probably be already engaged in supplying current to a TV receiver?

The trend to more table lamps, floor standards and illuminated decorative features arrived at the same time as a boom in the sale of electrical appliances of all kinds. Either of them alone could have caused a crisis in the wiring situation in the majority of homes. Together they have created a problem which calls for an immediate remedy.

Research into the extent of installation facilities in British homes would show that most of them are very inadequately equipped. This is not surprising seeing that the greater proportion of them were wired in the ten years preceding the last war. In 1929 one fixed lighting point per room was general, with probably a 5-ampere two-pin plug-point in the kitchen for an electric iron. By 1939 a fair proportion of new houses had one 15-ampere heating plug-point in each of the living rooms and larger bedrooms in addition to the one-point-per-room lighting installation.

If every home in the country to-day had an electrical installation wired according to 1939 standards they would still be woefully lacking from the point of view of convenience, and the facilities provided would be totally inadequate for the many things we now expect to do with electricity.

In 1939 an average small house of 1,000 square feet floor area would no doubt have the following electrical appliances: iron, vacuum cleaner, radio, table lamp and a small electric fire. In the large majority of them at least there would only be the fixed lighting points to which connection could be made. Small wonder that in those days electrical appliances were invariably sold with " adaptors " on the end of the flex ready to plug into a convenient lampholder.

A two-way lampholder adaptor made it possible to run both appliance and light at the same time. Provided one did not object to the lamp bulb sticking out six inches below the pendant lampshade and to the unsightliness of the adaptor and the flex, all apparently was well. The fact that an electric fire alone was loading the wiring up to its maximum rated capacity was almost always ignored.

It is probably true to say that there are to-day four or five million or more of these houses which, basically, have only fixed lighting points in them. The word " basically " is used advisedly, because the need to-day for means of connection of electrical appliances and portable lamps has brought the unskilled amateur into the picture, and the extensions made for that purpose, both temporary and permanent, are not only weird and wonderful but often dangerous.

One can hardly blame tenants of rented property for this. They have to-day the means to acquire electrical appliances which save much labour. They find electric fires useful to eke out their not-too-generous coal ration. The family demands TV and/or a radiogram for their entertainment, and they appreciate the value of good illumination which table lamps and floor-standards bring.

It is no exaggeration to say that the average family of 1939, who possessed in those days the bare minimum of iron, cleaner, radio, small fire and table lamp, would by now have acquired in addition: washing machine, electric clock (one or more), television, electric blanket, electric kettle, toaster, dry shaver (one or more), floor standard: and no doubt more portable lamps, table standards and bedside lamps, reading lamps, and so on.

Their pre-war installation would still be limited to five amperes per sub-circuit, but there are now some 20 appliances queueing up for an opportunity of being connected to the supply. True they will not all be wanted at the same time, but at least some should be permanently plugged in ready for instant use. The amateur " hook-ups " one sometimes sees in such houses baffle description. In one case it was reported that the switch in the living-room was strapped with cellophane tape to keep it on permanently. This was necessary because the lighting fitting supplied an electric clock through a three-way adaptor plugged into a two-way adaptor attached to the pendant lampholder! The two-way adaptor had a switch on one of its outlets into which was inserted a 150-watt lamp to provide the main lighting in the room. Long flexes from each of the remaining lampholder outlets were draped across the

ceiling and down the walls to supply the clock, TV receiver and a small electric fire.

In more modern houses where there is a 15-ampere plug-point beside the fireplace, it may be slightly easier to make it serve a number of appliances. In this case a three-way adaptor inserted in the plug-point can be used to supply a clock, electric fire and table-lamp. With a little ingenuity plus yards and yards of flex, and by "doubling up" adaptors, the original uncomplaining plug-point can feed electricity to five different appliances, providing the housewife puts up with the untidiness of the flex which may travel right round the room to reach some far-flung gadget. It is not uncommon to find in the dining-room of otherwise well-equipped and well-furnished homes the following appliances served by a network of wire lying on the floor—fire, clock, table-lamp, toaster and radio all in use at the same time, with possibly an electric kettle waiting in attendance to be plugged in as soon as the toast is made!

Such a state of affairs, in which too many plugs are chasing far too few socket-outlets, is already to be found in very many houses. Every day more portable lamps and floor standards are being sold; more washing machines, too, and a host of labour-saving and comfort-providing appliances. In Britain more than 500,000 electric dry-shavers were sold last year. Was there a plug-point ready to receive them in every case? Presumably so in some houses or they would never have been sold, but how many were plugged into bathroom pendants? One shudders at the thought of the dangers run by residents in so many "plug-pointless" houses.

The answer to this problem is, of course, the "ring circuit." Most electrical installation engineers will need no introduction to this new system of wiring for plug-points, but there are still many architects who so far have not appreciated what it can do for them and for their clients. They have been used in the past to the old "radial" system of wiring in which every 15-ampere plug-point had a complete circuit to itself originating from a centrally placed multi-way fuseboard usually somewhere near the meter position. (Fig. 1.) This old system is expensive to install both in material and labour. Because of its high cost architects have usually restricted 15-ampere plug points to one per room and have specified smaller five or two ampere points to be installed where table-lamps, etc., are likely to be used.

The variation in size of plugs and sockets has always been a bone of contention between architects and the electrical industry. The ring circuit overcomes the difficulty of having two sizes of plug-point in a house, as it is used with a new standard all-purpose socket-outlet rated at 13 amperes (Fig. 3), so that every plug-point is a heating or "power" point. It also eliminates the fuses by the meter, as every plug top is fitted with its own fuse (Fig. 4), which is rated according to the loading of the appliance which it serves. The plug-point can therefore be used for any appliance ranging from an electric clock to the largest electric fire.

The ring circuit, as its name implies, consists of a circuit which, starting from a main switch and fuse near the meter, proceeds round the house, visiting each plug-point, finally returning to its starting point. Additional points which are off its route can be supplied by means of "spur" cables connected to the ring, but not more than two plug-points can be supplied from any one spur.

The essential features of the ring circuit are shown in Fig. 2, which shows the physical route of the wiring and

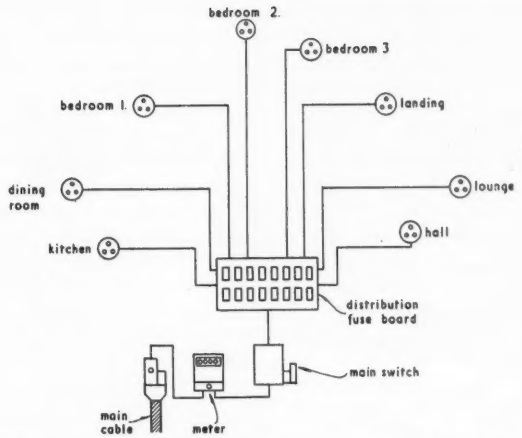


Fig. 1. Layout of wiring routes for eight 15-amp. plug points on the old "radial" system which is wasteful of cable and is incapable of expansion to any useful extent.

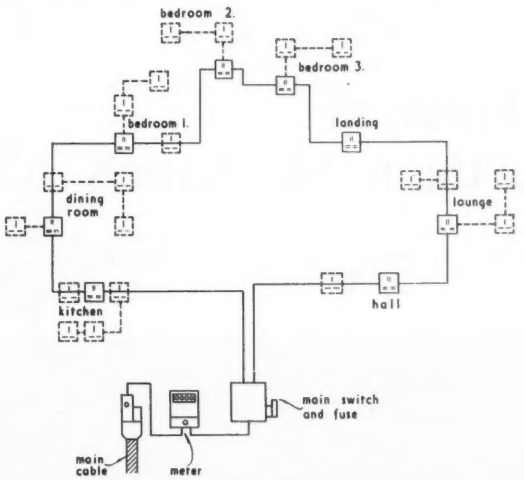


Fig. 2. Layout of ring circuit wiring route serving a maximum of eight 13-amp. plug points. A further 20 points (dotted) could be provided with little extra wiring.

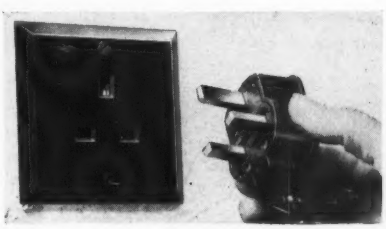


Fig. 3. Standard 13-amp. socket outlet and plug.

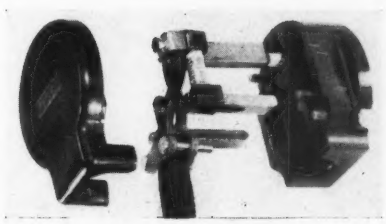


Fig. 4. Showing fuse in 13-amp plug.

not its actual electrical connections. The new standard plug and socket outlet (B.S.1363) must only be used with the ring circuit, the maximum capacity of each point being 13 amperes (say 3,000 watts), but the total capacity of the entire ring is 30 amperes (or 7,200 watts at 240 volts).

At the moment of writing this article the twelfth edition of the Institution of Electrical Engineers' " Regulations for the Electrical Equipment of Buildings " specifies one ring circuit for houses of 1,000 square feet floor area or less. The ring can then supply an unlimited number of plug-points. In houses above this size the number of points per ring is limited to ten, but it is hoped that the thirteenth edition of the above Regulations, now in draft form, will introduce some important relaxations in this respect. It should be noted that the number of plug-points supplied through spurs must not exceed the number actually connected to the ring itself.

Wiring for fixed lighting points, however, is not connected to the ring circuit but remains, as before, a separate circuit.

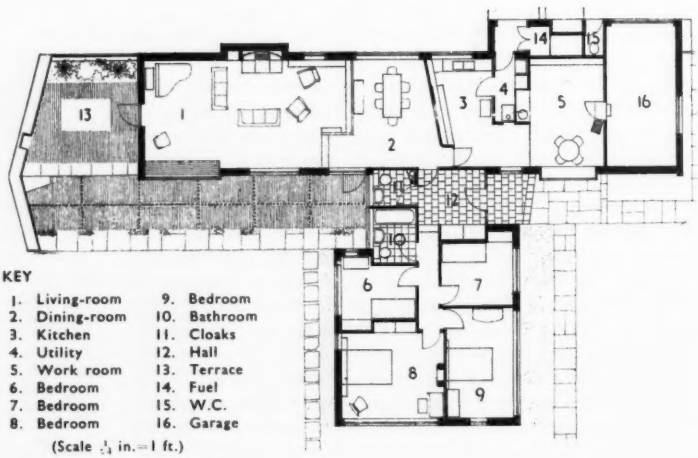
Here, then, is a solution to the problems outlined at the beginning of the article. The cost of providing an adequate number of plug-points by the ring circuit is undoubtedly cheaper than by the old radial system. As it will be seen that a minimum of three to four plug-points per room is necessary to obviate lengthy flexes and to provide facilities for the connection of all the electrical appliances likely to be found in the average home, it can be appreciated that upwards of 25 points must be installed in even the smallest house.

The ring circuit is the answer to a problem which has been baffling electrical engineers for very many years, and it is the biggest step ever made towards the convenient and safe use of electricity.

THREE HOMES in which particular attention has been paid to the lighting

House at Lytham St. Anne's

Architect: T. Mellor, B. Arch., A.R.I.B.A., A.M.T.P.I.



KEY

1. Living-room	9. Bedroom
2. Dining-room	10. Bathroom
3. Kitchen	11. Cloaks
4. Utility	12. Hall
5. Work room	13. Terrace
6. Bedroom	14. Fuel
7. Bedroom	15. W.C.
8. Bedroom	16. Garage

(Scale $\frac{1}{8}$ in. = 1 ft.)

Designed by the architect for his own occupation, this house has to cater for a family with varied interests. The living-room contains a piano, a radiogram, and storage space for gramophone records, a large number of books, periodicals and maps, in addition to normal living-room furniture.

The kitchen and the children's playroom adjacent to it form one large area which, in practice, is used also for family meals, for sewing, and for homework.

The house has a T-shaped plan, sited to give the living-room a south aspect. Brick load-bearing walls carry a tiled pitched roof over the living/kitchen area and a monopitch roof over the bedroom wing. A thermostatically-controlled anthracite boiler provides low-pressure hot water for concealed ceiling-panel heating.

Lighting

The variety of activities which occur in the two living areas suggested the use of numerous individual lighting points and there are, in fact, six wall lights in the living/dining area, and a rise-and-fall pendant fitting with a " Klint " shade over the dining-table. Three of the wall lights are intended to provide general lighting, three are for local lighting—for the piano, for drawing, and for sewing. They comprise simple aluminium reflectors on ball joints.

In the kitchen/play area there are three pendant fittings—two with " brandy glass " bowls, one with a " Klint " shade.

Elsewhere, there are no pendant fittings: in the hall and corridor there are two wall lights; in the main bedroom two wall lights and an " Anglepoise " lamp for reading; in the other bedrooms two wall lights;

Above, general view from S.W. Right, part of the living-room, with its dark, sloping ceiling.

and in the bathroom and cloakroom fully-enclosed glass ceiling fittings.

The open planning of the living areas has been found both attractive and practical, but it is expensive to light. In spite of the light-coloured walls, the area of 600 sq. ft. needs, with indirect reflectors, 400 watts.

External lighting is provided to the porch, the garage, and the terrace outside the living-room.

There was no general contractor; all trades were let separately. Electric wiring, Thistlethwaite & Edgar; lighting fittings, Merchant Adventurers, Ltd., Falk, Stadelmann & Co., Ltd.

Demonstration Flat at Blackheath

Architect: Eric Lyons, F.R.I.B.A., M.S.I.A.

The flat illustrated is a demonstration flat typical of those recently built, mostly in two-storey blocks, in a tranquil area near Greenwich Park. There are three types of flat: the "Arlington," with one large and one small bedroom, a 16-ft. 3-in. x 12-ft. 6-in. lounge, bathroom and kitchen; the "Berkeley," which is similar, but has a 12-ft. 6-in. x 9-ft. 6-in. extension to the lounge which can be used as a study, as a third bedroom, or as part of the living-room; the "Cavendish," a three-bedroom flat, with a 25-ft. long living/dining-room.

Construction comprises external walls mostly of 11-in. cavity brickwork, with tile hanging (special decorative tiles) to part of the front elevations of the two-storey blocks. The timber-framed roofs are covered with 1½-in. woodwool slabs and finished with mineralised roofing felt. Floors between flats are insulated against sound transmission.

Heating is by a high-efficiency modern-type open grate in the lounge, with electric fires in bedrooms. The lounge fire also provides hot water supply, although there is an electric immersion heater for summer use.

The kitchen, seen through door and window to living-room.

Left, living/dining room of "Cavendish" flat. Below, general view of estate.

Lighting

The flats are equipped with a large number of ceiling points and wall sockets, the latter at a convenient height above floor level, but these have not been allowed to dictate the positions of the lighting fittings, nor has any attempt been made to hide the flex connecting the fittings to the points or sockets.

There are two "fixed" sources of light in the living-room of the demonstration flat—a rise-and-fall fitting over the dining-table and a swivel-type wall fitting, with a spun aluminium reflector, over the fireplace—other lighting being provided by table lamps and standard lamps. There is a second rise-and-fall fitting, with a wickerwork shade, over the table in the kitchen, and another in the study/spare bedroom.

Each bedroom has a ceiling fitting for general lighting and a wall bracket fitting, for reading, over the bed. There is a fully-enclosed glass fitting over the kitchen sink, and a similar fitting on the wall above the lavatory basin in the bathroom.

The large picture windows have been provided with Venetian blinds, to prevent glare, and opening lights are horizontally pivoted.

General contractor, Wates Ltd.; lighting fittings, Bernard Schottlander, M.S.I.A., Fredk. Thomas & Sons, Ltd., H. G. Dunn & Sons, Ltd.; switches and socket outlets, Falk, Stadelmann & Co., Ltd.

House at Blackheath

Architect: Patrick Gwynne, Chartered Architect and design consultant.

This is a "rebuilding" of an early Victorian house which was severely damaged during the blitz. The original walls remained standing and most of these have been re-used, but two large bay windows on the garden front have been removed and replaced by larger French windows.

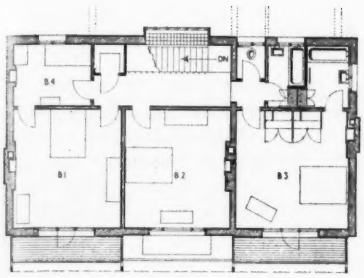
Kitchen, with storage and display unit on right.

The new pitched roof is of slate-coloured asbestos-cement sheeting, with a curved ridge. At the rear, the eaves overhang by 5-ft., to shield the bedroom windows from summer sun. The overhang is supported by inward-sloping timber posts, which also support balconies to two of the bedrooms.

Other alterations include the addition of a small ground-floor cloakroom in space taken from the very large vestibule, and the construction of a false ceiling to the living-room, as a contrast to the very high—11-ft. 6-in.—ceilings elsewhere.

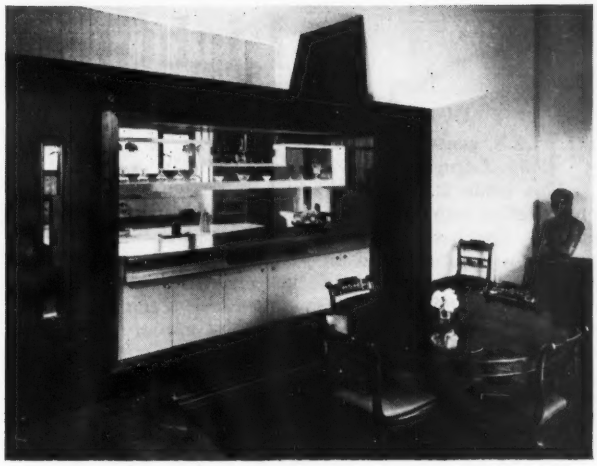
An opening has been formed between the living-room and the dining-room, and the wall between the dining-room and the kitchen has been replaced by an elaborate storage and display unit for crockery, etc.

On the first floor there is a new



Ground and first-floor plans scale: $\frac{1}{24}$ in. = 1 ft.)

Right, dining-room, looking towards kitchen.



toilet suite, comprising two bathrooms and a w.c.

Lighting

Particular attention has been paid to the lighting of the kitchen: a contemporary-style "chandelier" lights the central table and provides general reflected light for the remainder of the room; there is a light in the hood over the cooker; another over the sink; and a striplight over the counter of the storage unit between the kitchen and the dining-room lights the counter and gives sparkle to the glasses on the shelves above it.

Apart from a rise-and-fall fitting with a "Klint" shade over the dining-table, there are no other pendant fittings on the ground floor; the living-room, for example, is lit entirely by portable fittings—table lamps and standard lamps. In the hall, a wall fitting on the staircase wall illuminates both the hall and the staircase. Lighting of the bedrooms was left to the discretion of the client.

Main contractor, Leslie Bilsby, Ltd.; electrical contractor, F. Rogers, Ltd.; lighting fittings, A. Arden & Co., Ltd., Troughton & Young, Ltd.

Above and right, two views of garden front.

Lighting Abstracts

OPTICS AND PHOTOMETRY

185. I.E.S. general guide to photometry. 535.24

Illum. Engng., **50,** 147-152 (*March*, 1955).

This guide is being published in sections, the present ones dealing with basic principles of photometry and photometers. The basic principles cover the inverse-square and cosine laws. The section on photometers deals with visual, photo-electric and radiometric instruments. Other sections of the guide will be published in a later issue of *Illum. Engng.*, and the complete guide will eventually appear in reprint form. P. P.

186. Colours under the light from lamps. 535.64

C. Roy-Pochon, *Bull, Soc. Franc. Elect., 7th Ser.*, **5,** 109 (*Feb.*, 1955). *In French.*

Part I: Identification of colours. A clear exposition of the C.I.E. system of colour indexing, with examples of its use in calculations of colour mixture and to mixtures of light from tungsten and fluorescent lamps. Part II: Colour rendering. A discussion of colour rendering, effects of spectral distribution, colour adaptation and the spectral-band method. A suggestion is made for a new division of the spectrum into eight spectral bands based upon complementaries, on the argument that the rendering of near-white colours depends upon the balance of complementary hues. Compromises have to be made in some regions; a solution is propounded with the characteristics of fluorescent lamps particularly in mind. J. M. W.

LAMPS AND FITTINGS

621.327.43

187. A new low-cost dimmer for hot cathode fluorescent lamps.

A. Davis, R. E. Stephenson and L. D. Harris, *Illum. Engng.*, **50,** 143-146 (*March*, 1955).

Reduction of line voltage on conventional hot cathode fluorescent control circuits permits a reduction in lamp brightness to only about 50 per cent. before the lamp extinguishes. A circuit is described which permits brightness variations of 100 to 1 or more by using separate windings on the ballast transformer to maintain the voltage to the cathode heaters and an earthed metal plate to promote ionisation and facilitate starting at any brightness level. P. P.

621.327.4

188. Operation of mercury vapor lamps on series street lighting circuits.

M. E. Keck and W. A. Oglesbee, *Illum. Engng.*, **50,** 115-121 (*March*, 1955).

Describes a method for operating 400-watt American-type E-H1 mercury vapour lamps from a series circuit in which a constant current transformer is used to provide a current in the circuit equal to that at which individual lamps operate. Details of both the moving-coil and static types of current regulators are given. The moving coil regulator has certain advantages for street lighting work. The operation of the circuit under abnormal power supply conditions and under interruptions of relatively short duration (one-half to five cycles) is discussed. P. P.

LIGHTING

189. Towards better lighting. 628.9

J. Wetzel, *Lux*, **23,** 6-10 (*Jan.-Mar.*, 1955). *In French.*

Outline of a campaign for better lighting, in which the roles of the lamp-maker, the manufacturer of lighting equipment, the contractor, the architect and the consulting engineer are discussed. The needs for instruction of each are outlined, and possible teaching arrangements are outlined. J. M. W.

628.92

190. A modified lumen method of daylighting design.

J. W. Griffith, W. J. Arner and E. W. Conover, *Illum. Engng.*, **50,** 103-111 (*March*, 1955).

A continuation of the lumen method described in *Illum. Engng.*, Jan., 1953, which enables the daylighting to be calculated for three positions in a room with windows having clear glazing or a diffusing control (translucent glass, curtains, etc.). A considerable number of curves derived from the results of model studies are used so that the constants in the lumen formula can be readily obtained for a large number of room conditions and for three types of sky. P. P.

628.971.6

191. Trends in present-day street lighting development.

P. Sandgren, *Ljuskultur*, **27,** 3-8 (*Jan.-Mar.*, 1955). *In Swedish.*

Recent street lighting installations in Western Germany, Belgium and Holland are described with photographs. In Germany full advantage has been taken of the opportunity, provided by post-war reconstruction, of installing the newest apparatus, and special attention has been given to the use of fluorescent lighting with high mounting. In Holland installations have been tried of fluorescent tube units extending over the whole width of the road, in order to assist visibility on wet roads. An experimental run of 1 km. of such extended-source lighting, 1 km. of H.P.M.V., and 1 km. of sodium lighting has been installed, from which a choice is to be made of the preferred system. Belgian practice embraces all types of light source. In Frankfurt fluorescent M.V. bulbs are preferred to tubes for robustness and convenience in handling. There is also a reference to the sodium tunnel lighting at Antwerp (Scheldte Tunnel) and Rotterdam (Maas Tunnel). The general conclusion is that discharge lighting is rapidly supplanting incandescent filament lighting. R. G. H.

192. A glance at street lighting in Belgium. 628.971.6

Anon. *Lux.*, **23,** 13-14 (*Jan.-Mar.*, 1955). *In French.*

A brief review of the virile developments of public lighting particularly by fluorescent lamps in Belgium, and a discussion of the conditions which have brought it about. It is noted that uncorrected H.P.M.V. and sodium lamps are tolerated in Belgium, as they are in Britain, whereas they would not be in France on account of the unacceptable colour. The use of diffusing envelopes for fluorescent lanterns is noted as a departure from conventional practice, but it gives a satisfactory result. Cut-off distributions are used, sometimes with excessive cut-off giving a ladder effect; but for fluorescent lamps this distribution is not used. These preferences depend largely on habit; by day we have the most glaring source known, which would be rejected by any competent lighting engineer. The impact is felt of the H.P.M.V. fluorescent lamp, but tubular fluorescent lamps have made a conquest of the street lighting market in record time. J. M. W.

Experiments in Side Street Lighting with a Scale Model

By G. M. DOREY*

The lighting of side streets has necessarily received less attention in the past than the lighting of main roads. This article describes experiments on the subject which were made with the aid of a model.

Nature of the Problem

The term "side street" has a broad meaning. Primarily it refers to roads which carry local vehicular and pedestrian traffic only. These roads, however, differ in many ways, ranging from the broad road lined with trees with a wide footpath and grass verge with houses set well back, to the narrow street hemmed in on both sides by rows of terraced houses.

Much less attention has been paid to the satisfactory lighting of side streets or Group "B" roads, than to that of Group "A" roads or traffic routes. The main requirement in lighting Group "A" roads is to facilitate the passage of road traffic, and this is accomplished by exploiting the preferential reflection properties of the road, so producing a high road surface luminance against which any object of material size is clearly visible.

Existing side street installations have attempted to use this lighting technique, but the Ministry of Transport Departmental Committee, in their final report on street lighting, recommended limitations on the power, mounting height and spacing of the lamps used in side streets partly in order to differentiate them from traffic routes. These recommendations were as follows:—

(1) The average spacing should not exceed 120 ft.
(2) The mounting height should be between 13 and 15 ft.
(3) The output of the lantern should be between 600 and 2,500 lumens per 100-ft. linear.

Interpreted in watts per post using tungsten filament lamps, these figures correspond approximately to 60 and 200 watts.

This is a severe reduction when compared with the 300-750 watts per post and the 25-ft. mounting height recommended for traffic routes, so that to employ the traffic route technique in side streets must inevitably result in poorer revealing of objects. There is insufficient light and too low a mounting height to produce a high road surface luminance without glare, and in consequence small patches of fairly high luminance are created on the road and pavement near each lamp-post, the rest of the field being left dark and confusing.

An installation which produces that sort of effect cannot be called satisfactory. Furthermore, the functions of side street lighting differ from those of traffic route lighting in that the pedestrian rather than the driver takes first place. According to the M.O.T. report it is not the function of the lighting in side roads to enable motor traffic to proceed in safety without headlights.

The object of the experiments described in this article was to investigate the effects of varying the factors which are involved in the lighting of side streets and to ascertain how best to use the available light flux. In particular it was required to determine what effect the following factors had on the revealing of objects in the installation and the appearance of the scene:—

(1) Varying the power of the lamps.
(2) Varying the light distribution.
(3) Varying the road surfaces.
(4) Varying the sizes, number and positions of trees.
(5) Alteration in the building line of the houses.

The very nature of these questions made it clear that they could not be answered satisfactorily by full-scale experiments, and a scale model was therefore constructed.

Description of Model

By virtue of its movable parts, the model could be adapted to simulate several types of side street. A scale of one-fortieth was chosen so that a fairly long stretch

* General Electric Co., Ltd.

of road could be represented on a model which would fit in with the limited space available in the laboratory, and yet be sufficiently large to enable the component parts to be made reasonably accurately.

The model consisted of a length of road 7½ ft. long and 4½ in. wide (300 ft. and 15 ft. to scale), intersected nearly half-way up at right angles by another road 4 ft. long and 7½ in. wide (160 ft. and 25 ft. to scale). This arrangement permitted the study of the lighting of intersections and the effect of different road widths. The road surfaces were made of flat aluminium sheet and had different surfaces on each side. A rough type of surface exhibiting matt reflection characteristics was imitated by the use of a light-coloured synthetic rubberised cork sheet glued on to one side of the aluminium. On the other side a sheet of very dark grey paper slightly polished with "Ronuk" was glued on, and found to simulate approximately a well-worn asphalt surface. The kerb, grass verge and pavement, having a total width of 7½ ft. to scale, were simulated by a brass girder, shown in Fig. 1, having two insulated metal busbar strips in which either lamp columns or trees could be fixed at any desired position.

The bases of the lamp-posts and trees were made identical. On the bottom of each post were fixed two small contacts (Fig. 2) which could be clipped in under the brass strips to support the post and conduct the supply. The contacts of the trees were, of course, merely insulated from each other.

The shape and size of the trees were decided upon after observation and measurement of trees in the neighbourhood. The dimensions of an average tree are shown in Fig. 3. The foliage was represented on the model by glueing steel wool suitably shaped on to the top of the stems. Difficulty was experienced in colouring the steel wool, and it was left grey. The illumination level throughout most of the experiments was sufficiently low to make colour unimportant in judging the appearance of the road. Houses of different types, built to scale and movable, enabled various built-up areas to be demonstrated, model gardens and fences being provided where necessary. The model is shown by "day" in Figs. 12 and 13 with the two arrangements of trees described below and a "night" view as seen by an observer is shown in Fig. 14.

Lighting Equipment

The circuit consisted of a simple ring main (Fig. 4), which enabled a lamp to be plugged in and out of the circuit without breaking the continuity. This main was fed by an A.C. supply controlled by variable autotransformer giving smooth control from 0-3 volts.

The directional candle-power of each lamp was determined at a series of busbar voltages and multiplied by the scale factor ($40^2 = 1{,}600$). This enabled a candle-power scale to be drawn and placed over the voltage scale on the voltmeter, so that the power of the lamps could be read directly in full-scale intensity or in watts.

The scale of the model was too small to permit the construction of replicas of full-size lanterns, and a method of obtaining the required light distribution by obstruction had to be adopted—3.5-volt round-bulb torch lamps were found to be suitable sources: the cap was removed and the bulb mounted on the top of a piece of hollow ebonite tube of ¼-in. outer diameter. Small glass cylindrical covers were made which fitted closely over the lamps, and the required light distribution was obtained by appropriately painting and spraying the cover.

The three types of distribution used are shown in Figs. 5, 6 and 7. Fig. 5 represents a bare lamp distribution with a symmetrical cut-off at about 80 deg. Fig. 6 represents a concentrating cut-off symmetrical distribution with a peak at 72 deg., a cut-off at 80 deg., and a sharp fall in intensity at the lower angles. Fig. 7 repre-

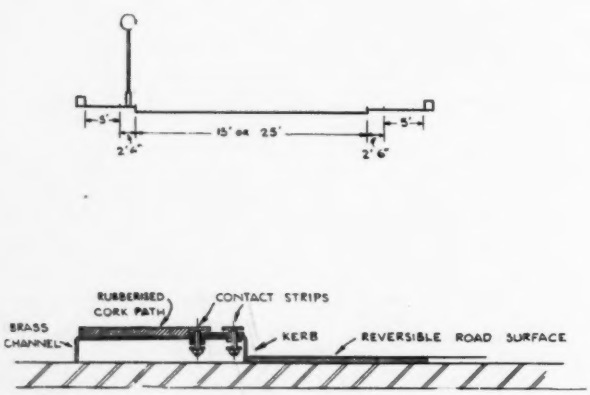


Fig. 1.

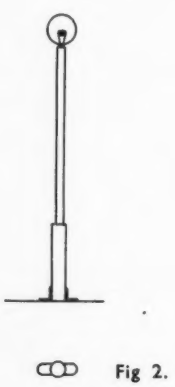


Fig. 2.

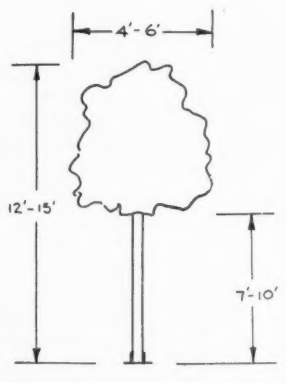


Fig. 3.

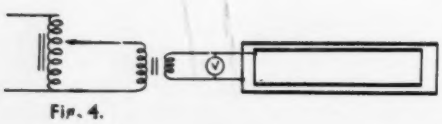
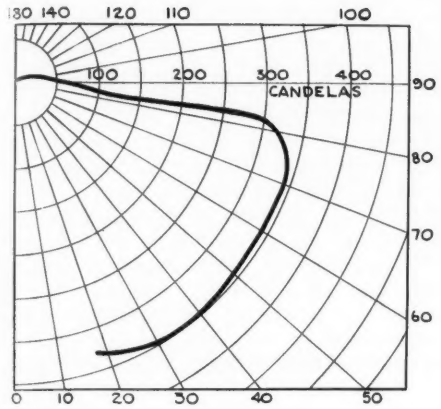
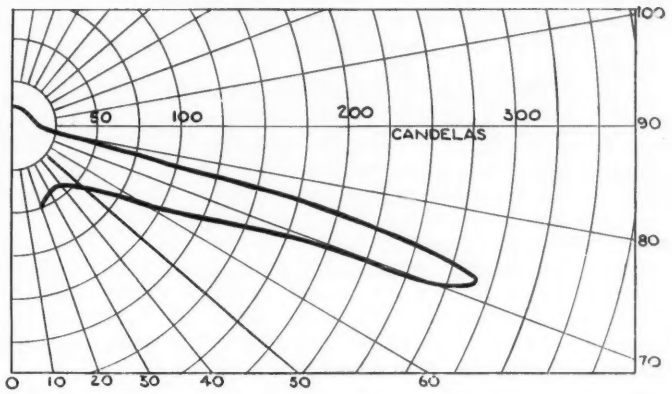


Fig. 4.

Fig. 1. Sections of model street giving dimensions and details of contact strips.
Fig. 2. Lamp and column with contacts.
Fig. 3. Model tree with dimensions.
Fig. 4. Electrical circuit.





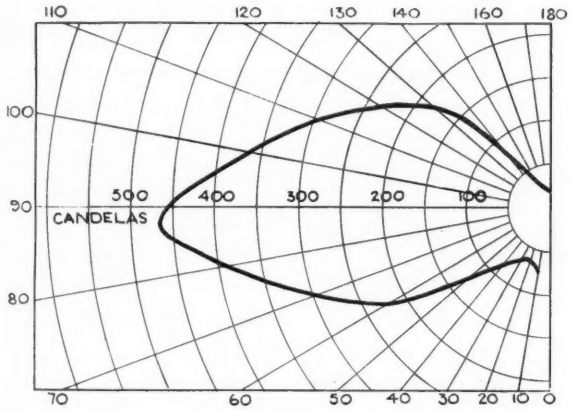
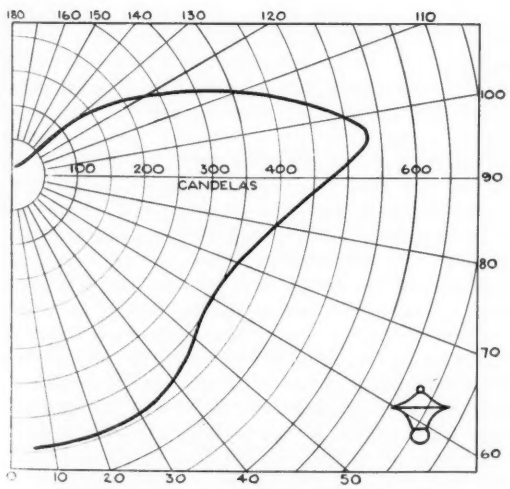


Fig. 5. (top left) Light distribution—bare lamp with symmetrical cut-off.

Fig. 6. (above) Light distribution—concentrating cut-off.

Fig. 7. (left) Light distribution—concentrating non cut-off.

Fig 8. (below) Light distribution—"bare lamp" (with typical full-scale lighting fitting).



sents a concentrating non cut-off type symmetrical distribution with a similar distribution to Fig. 6 from 0-70 deg. from the vertical and bare lamp distribution above those angles.

For future reference the three distributions will be referred to as:—

(1) Bare lamp with cut-off.
(2) Symmetric cut-off.
(3) Symmetric non cut-off.

The bare lamp distribution and the lighting fitting to which it refers are shown in Fig. 8. The inverted cone-shaped vitreous enamelled reflector was simulated by painting a black dot of correct size on to each lamp so that light could not be emitted above an appropriate angle.

Candle-power Correction for Fittings

The light output ratio of the models of controlled distribution was much lower than that of their prototypes, since the distributions were obtained by obstruction of the light. This obviously has to be allowed for in calibrating the wattage of the lamps.

The light output ratio of these model fittings was measured in a small cubical integrating photometer.

Owing to the allowance that has to be made for the lost light in the fittings, the range of watts available in each distribution varied as follows:—

	watts
Bare lamp	0—1,000
Bare lamp with cut-off	0— 500
Controlled non cut-off	0— 500
Controlled cut-off	0— 200

Nature of Experiments

In the experiments two main factors were studied:—

(1) The capacity of different types of installation for revealing objects, and the effect that factors such as trees, road surface, etc., have on that capacity.
(2) The degree of comfort, well-being and confidence that such installations under varying conditions produced in an observer; i.e., the "appearance" of the scene.

To investigate these it was necessary to conduct observational experiments, employing several observers in order to obtain useful results.

The longer and narrower street was used throughout

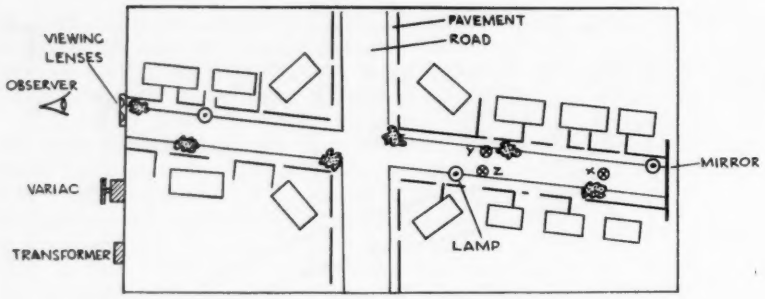


Fig. 9. Plan of model showing three standard object positions.

all the investigations. An observer was seated at one end, with his eyes about 5 ft. to scale from the road surface. The eye position was determined by means of two lenses, one of which viewed straight down the pavement, and the other down the left-hand side of the road about 5 ft. to scale from the kerb. These lenses served two purposes, one to show the observer where to place his eye, and the other to collimate the view approximately, giving images of the street and objects at a great distance. One eye only was used throughout each experiment. It will be appreciated that if two eyes were used at that small scale they would be about 10 ft. apart to scale and would give a stereoscopic effect out of all proportion to that experienced in practice.

To imitate night conditions black curtains were erected round the model. Owing to its small size only a relatively short stretch of road could be represented, which, when viewed by an observer, disappeared abruptly into complete darkness. It not only looked unrealistic but gave insufficient background against which objects could be seen. The apparent length of the road was therefore doubled by placing a large mirror at the far end.

The effect of the images of objects placed near the mirror was not disturbing, and the reflection of the viewing lens could not be seen. Furthermore, if required, the effect of a bend or incline of the road could be observed by movement of the mirror.

Revealing of Objects

To assess the revealing of objects in an installation a test object was used. It consisted of two cones which, when placed end to end, measured about 1½ in. in length, which to full scale represented the average height of a pedestrian. By the use of two identical cones, either of which could be inverted, four distinct shapes could be formed. This made it convenient to observe the effect of shape on visibility and gave a more definite criterion of recognition. The colour of the cones was black, but the effect of grey was experimented with.

The object was placed in one of three positions for each observation. These positions were chosen to represent the different ways in which, and the different backgrounds against which, an object would be revealed. Fig. 9 illustrates these positions.

Observational Technique

In the visibility experiments the power of the lamp was increased until certain degrees of visibility were obtained according to two describable criteria:—

Criterion I—that degree of visibility at which an object could just be seen but not recognised, producing the sense in the observer that it was something material to be avoided;

Criterion II—that degree of visibility at which an object could be correctly distinguished as a definite shape.

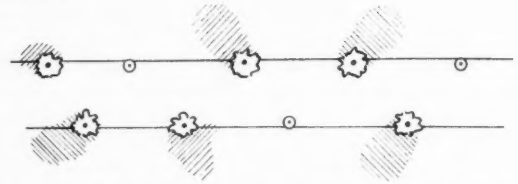


Fig. 10. Plan with suitable tree arrangement (Plan A) (See Fig. 12).

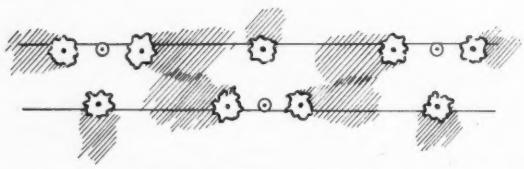


Fig. 11. Plan with unsuitable tree arrangement (Plan B) (See Fig. 13).

After a few preliminary observations the procedure finally adopted for making visibility measurements was as follows:—

The observer sat at the model and waited about five minutes for his eyes to become adapted. During this time an object representing one of the four shapes was placed in position X. The observer viewed from the road position through the right-hand lens. He increased the brightness of the lamps until he could see the object according to criterion I, and a reading on the "wattage" scale of the voltmeter was taken. He then increased the brightness further until criterion II was satisfied, and another reading was taken. The two observations were repeated on the three positions X, Y and Z, changing the shape each time in a way unknown to the observer. Observations were made with the four light distributions and with changes in the road surface, house-building line, lamp-post spacing and (most important of all) tree siting.

Two arrangements for tree siting were evolved. Fig. 10 illustrates a plan which might be called the best case designed so that most of the shadows were cast away from the road. Fig. 11 illustrates the worst case, in which the trees are clumped around the lamps, resulting in dark shadows across the road. In both plans the tree foliage simulated summer conditions or that of greatest obscuration.

In the appearance observations several observers were asked to comment on glare; whether a cut-off

system created a feeling of depression; whether there was sufficient light on the houses, and so on. The observers used were not all skilled.

In these observations the observer had no control over the power of the lamps, which was fixed at the equivalent of 100 watts per post. The only factor that was altered was the light distribution.

The road was first set up with a light-coloured matt road surface, trees in best plan (Fig. 10), houses set back, post spacing equivalent of 120 ft., and an object in position X, which helped an observer to form an opinion of the revealing of obstructions. The lighting installations were presented in turn.

The observer was asked to close his eyes during the change so that a mental picture of the previous scene could be retained.

Finally he was asked to adjust the power of the lamp until what he considered a satisfactory brightness level was reached for each installation.

Results

In side street lighting the conditions are so diverse that quantitative data obtained from visibility and brightness measurements on model experiments can only act as a guide. An installation may give very different results in different streets owing to the variations of factors such as tree layout, road surface and building line of houses. For this reason the main emphasis has been laid on qualitative data describing the effect that various factors had on revealing objects and the appearance of the street scene.

In traffic route lighting the background is nearly always sufficiently bright to enable an object to be seen by silhouette. This is the most economical way of obtaining good revealing power with a limited light output from each lantern.

In side street lighting the limitation on light output, and in many instances obscuration by trees, produced an uneven background brightness; some parts of the background were so dark that an object could only be made visible by direct lighting. This occurred at position Z in the model experiments. In such a position the light output of the lamps had to be raised very considerably before an object became adequately visible. If objects were to be adequately revealed at all positions an absurd light output would have to be used. For this reason it was important to try to eliminate dark shadows and areas, so far as possible.

The Effect of the Shape of an Object

The shape of an object, as long as it was familiar, had very little effect on its conspicuousness. The background was frequently made up of a mosaic of bright and dark patches against which an object was seen—part of it against a bright patch and part against a dark patch, resulting in the latter part being very often invisible. This caused a little confusion in visibility criteria because to make the invisible part of the object visible would need an absurdly high light output. For this reason the part that could be seen was taken as the criterion, bearing in mind that in practice, as long as part of an object was clearly visible, it would be sufficient indication to warn a road user that there was an obstruction ahead which should be avoided.

In the majority of positions an object was seen by silhouette, in which case a dark object accentuated the contrast between itself and the background and increased visibility. Where an object is revealed by direct lighting a light colour is an advantage.

Brightness of Background

Much experimental work has been done on the background brightnesses necessary to reveal objects of given brightnesses, and it was interesting to note that the results of critical brightness measurements taken on the model agreed with those found by Dunbar at full scale.*

The brightness against which an object could just be seen clearly enough to be distinguished was approximately .03 ft.-L. Below this level an object could not really be distinguished, and a pedestrian would not be likely to feel confident that he could see all obstructions when walking down a road lit to this level. Above this level, increase in the power of the lamps causes only a small improvement in the revealing of objects at a given point, as would be expected from the work of Smith and Waldram.† Psychologically, however, the increased brightness of the scene produced a feeling of cheerfulness and well-being.

A variation in the light distribution, whilst keeping the equivalent watts per post constant, affected the pattern of brightness and therefore the revealing power of the installation.

A more or less uniform brightness of the background, or at least of the carriageway, is obviously desirable if it can be achieved without glare. In practice, however, to distribute the limited light output available in side streets, so that a uniform background brightness is obtained may result in an average brightness much below .03 ft.-L. This would then afford bad visibility and be depressing. It may, for this reason, be advantageous to have a background of noticeable brightness diversity when power is limited.

Visibility with different light distributions

It is interesting to compare the effects of the four different types of distribution.

Bare lamp distribution

This type of installation had no definite control over the light, with the result that a bright patch was created around the lamp-post leaving a dark area in between the posts. A complicated mosaic of background brightnesses was produced. At 100 watts per post the dark areas fell below .03 ft.-L., which led to poor revealing of objects.

Bare lamp with cut-off

The main noticeable effect here was the absence of glare which gave an observer a sense of comfort. The revealing of objects was apparently improved slightly. This was not necessarily a direct outcome of the elimination of glare but may be partly due to better utilisation of light that was previously emitted above the horizontal. Cut-off distributions require, however, rigidly maintained spacing or a very patchy result will be produced.

Controlled cut-off

There were two main effects here; firstly absence of glare and secondly a more uniform and higher average brightness. It was successful to a certain extent in eliminating dark areas by redirecting the light from the lamp and concentrating it in the direction of those

* Trans. Illum. Eng. Soc. (London), **12**, 187 (1938).
† Ibid., **12**, 173 and 196 (1938).

areas where a higher brightness was required. The maintenance of correct spacing is again important.

Controlled non cut-off type

Once again a fairly uniform background brightness was produced, but when the lamps were running at 100 watts per post the brightness was slightly below the threshold brightness. As there was no cut-off, this accentuated the contrast between the bright sources and low brightness of background and produced uncomfortable glare.

Below is a table of brightness measurements taken separately on the two types of road surface with the lamps running at the equivalent of 100 watts.

TABLE 1

Distribution	Rough Surface Brightness in ft.-L.		Well worn Surface Brightness in ft.-L.	
	Max.	*Min.*	*Max.*	*Min.*
Bare lamps	.03	.01	.045	.02
Bare lamps with cut-off	.06	.02	.1	.02
Controlled cut-off	.04	.03	.07	.02
Controlled non cut-off	.035	.025	.06	.01

Some other factors

Road surface

In the model experiments two extremes were taken, the light coloured rough surface and the dark well-worn surface. It was found that there was little difference between them in the revealing of objects in an installation. The mounting height and the power of the lanterns were too small to produce elongated patches of light on a well-worn surface. It can be seen from Table 1 that the average brightness of the well-worn surface is slightly higher than that of the other type. This is chiefly due to a series of small patches of light of high brightness; however, in between are relatively dark areas.

Where the lamps are obscured by trees and the reflection of the surface cannot be exploited, a light coloured surface would have a slight advantage. From experiments with trees in Plan B the two types of road surface can hardly be distinguished.

Glare

No direct experiments were made on glare, but observers were asked whether they experienced any glare from the different systems. Slight glare was complained of from the bare lamp system, but the worst offender was the controlled non cut-off system. This was almost to be expected because this distribution, by lowering the brightness of the background, increased the contrast between it and the source.

In side street lighting, glare may be more accentuated than in traffic route lighting. The mounting height is lower which brings the light source nearer to the line of vision, and the low light output of the lamps and the nature of the surrounds conspire often to produce a rather dark background, which more than compensates for the lower candle-power produced.

Effect of terraced houses

The building line of the houses was brought up to the property line to observe the effect on the street scene. There was no appreciable improvement in revealing of objects, but the street gave the appearance of being better lighted owing to the brighter background of the houses. Furthermore, the sources were now being seen against this background which reduced the discomfort effect of glare.

Effect of closer spacing

When using cut-off fittings a closer spacing of 100 ft. may be an advantage in producing a more even background brightness. It was found, however, that with a bare lamp system at 100-ft. spacing there was an appreciable increase in glare. However, revealing of objects was not noticeably affected.

Trees

There were two main factors to be considered concerning trees:—

1. Their daytime appearance in the street.
2. Their effect on the lighting installation at night.

Trees in a side street greatly enhance its appearance and for this reason experiments were made to determine the best compromise between tree and lamp-post siting.

Scanlon and Reid* in their paper on side street lighting describe the types and rate of growth of trees frequently met with in side streets. The type and size of tree used in the model experiments was based on the average size and form of tree existent in side streets in the author's neighbourhood. (See Fig. 3.)

It was found that these trees varied in numbers ranging from 20 ft. to 60 ft. apart. In the majority of streets they were nearer 30 ft.

Trees are not so great a problem in the winter due to their lack of foliage. In the summer, however, they become so thick that they frequently completely obscure the light source and this is the condition that was mainly considered in the experiment. Hence the use of steel wool to represent the tree foliage, through which a light source could not be seen.

In the experiment described two tree plans were investigated, one (plan A) being a layout designed to maintain a certain number of trees for appearance and yet interfere with the lighting as little as possible.

It was found that there was no appreciable loss in revealing of objects. There were a few more shadows cast across the pavement, but these were not serious. Vision from the pavement through to the road was impaired by the increased number of obstructions created by the tree trunks.

In plan B, designed to represent an exaggerated case of what frequently occurs in practice, the whole scene was very much changed. Large black shadows were thrown across the road, producing a confusing background. All the light sources were obscured, and the revealing of objects severely impaired. In certain positions, objects became completely invisible even though the lamps were running at the equivalent of 1,000 watts. The two arrangements of trees can be seen in Figs. 12 and 13.

Under these circumstances, careful lopping may improve matters considerably. Owing to the low mounting height overhang is not practicable. If a central suspension could be adopted economically the mounting would have to be raised to something over 15 ft.

* Illuminating Engineering, **43,** 339 (1948).

Fig. 12. *"Day" view of model street with trees as in Fig.* 10.

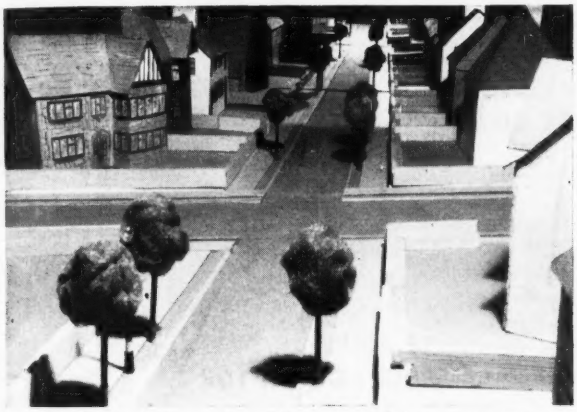


Fig. 13. *"Day" view of model street with trees as in Fig.* 11.

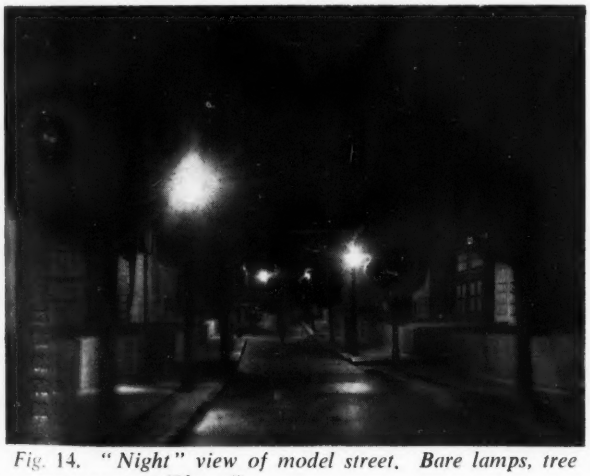


Fig. 14. *"Night" view of model street. Bare lamps, tree arrangement (Plan A).*

Observers' Opinions

There is no hard and fast rule as to what is good or bad side street lighting. Assuming the revealing power of an installation to be tolerably good, whether it is really satisfactory depends very largely on individual taste. The main purpose of the experiment already described was to try to discover which of the four distributions was preferred, together with the reasons why.

Observers' opinions may be summarised as follows.

Controlled cut-off

Advantages	Disadvantages
(1) Good revealing power.	(1) Sharp cut-off on houses.
(2) Very little glare.	(2) Highlight produced on nearby houses by the concentration of light at the peak angle.
(3) No waste of light.	
(4) Uniform background brightness.	
(5) Minimum of dark shadows.	(3) Critical spacing.

This system was agreed by the majority of observers to be the most satisfactory of the four. The effect on the houses was disliked because of the sharp cut-off and highlight produced just below. Some form of diffusion could well have been adopted here so that the houses were illuminated more uniformly.

Controlled non cut-off type

This system gained second place. It shared some of the advantages of the cut-off system, namely, uniform background brightness, minimum of dark shadows, moderate revealing power and furthermore, a satisfactory illumination on the houses. Its main disadvantage was glare, which many observers thought very uncomfortable.

Bare lamp with cut-off

This system gained third place. The cut-off was its major asset with its consequent little glare. As there was no light control below the cut-off, the resultant effect was of bright patches beneath the lamp-posts with dark areas in between. Objects were not so well revealed as by the previous two systems. The effect on the houses was liked as the cut-off was not too severe.

Bare lamps

This system was almost unanimously agreed to be the least satisfactory. Observers complained of slight glare. The general appearance of the scene was described as depressing. The light distribution produced a patchy background brightness resulting in poor visibility.

Conclusions

This work has done no more than touch on the principles involved in side-street lighting. The results of the model experiments done so far have shown some of the effects of various factors, which may prove useful in making further investigations in full-scale practice. Furthermore they have indicated which factors are most relevant and how they compare with modern traffic route lighting techniques.

It has been found that trees are a major problem. Where obscuration is severe, no reasonable increase in light output or change of light distribution would appreciably increase revealing power. The answer lies in a different siting relative to the lamp-post or where this is not possible, a rather severe tree-lopping may have to be adopted.

The low mounting height has increased the problem of glare. If fluorescent lamps and gear could be produced relatively cheaply they might have many advantages in this respect.

A certain amount of light on the houses is important. It enhances the appearance of the scene, facilitates the convenience of both residents and pedestrians, and complies with police requirements.

Some form of light control, in an attempt to obtain a uniform background brightness is desirable. It helps to eliminate dark shadows, which are a source of confusion, and which are conducive to poor revealing of objects.

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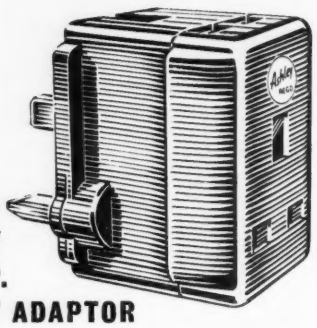

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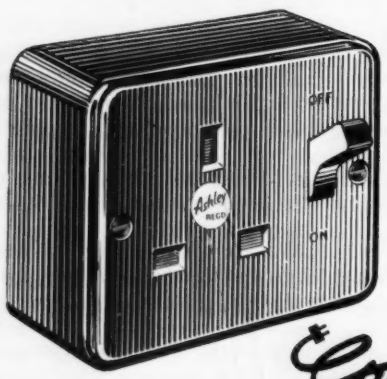

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Lighting Installation

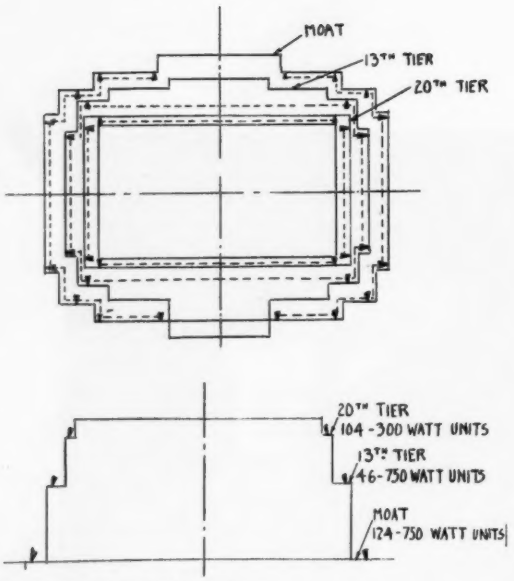
Archives Building from Constitution Avenue

The National Archives, Washington, D.C.

A recent addition to the number of public buildings which are floodlit in Washington D.C. is the National Archives Building which houses, amongst other important documents, the Declaration of Independence, the Constitution and the Bill of Rights.

The building occupies a whole block and when it was built some 25 years ago provision was made for floodlighting by the installation of special conduit, junction boxes, etc. Apart from some cleaning this equipment was found to be still serviceable.

As shown in the sketch floodlights were located at three different levels, the moat, thirteenth and twentieth tiers. Some 274 floodlights (300- and 750-watt tungsten



Schematic floodlighting layout

The rear of the building from Pennsylvania Avenue

Showing mounting of 750-watt floodlights in the moat

Showing mounting of 300-watt floodlights at twentieth tier.

lamps) are used, their location and beam spread being such that the level of brightness increases towards the top of the building. In the moat both wide angle and narrow angle projectors are used; on the thirteenth and twentieth tiers only wide angle projectors are used.

The floodlighting is controlled by an automatic time switch and operates from dusk until 10 p.m. every evening.

At the moat and thirteenth tier levels the trunion arms of the floodlights are bolted into the masonry. At the twentieth tier as the floodlights had to rest on the roof they were mounted on hardwood as seen in the illustration.

The floodlighting was planned by the Electrical Section of the General Services Administration, Washington.

Prescribing for Seeing

By M. L. BERSON, F.B.O.A. (Hons.)

Much reliance is placed in industry on the ability of workers to see. Correct lighting helps people to see—so do spectacles and other aids to vision. The following article discusses all these factors.

Profits, bonus, productivity are words of importance in the language of industry, affecting man, master and, indeed, the whole national economy, with particular urgency at the present time. New machines, materials and techniques are used to increase and speed production. Health and welfare services maintain the man at his work. Everything is designed for efficiency and progress, that is, everything but Seeing!

Eyesight is industry's most useful tool. It is so flexible in its many uses that it will function somehow, even in extremely adverse circumstances. Its very flexibility results in tolerance to abuse. The complex nature of the process of seeing has stimulated many investigators to inquire into its mechanism. The results of their researches have determined not only fundamental principles of function but also remedies of defects of these functions. The application of the knowledge thus gained is a specialised field of work, and it is therefore not surprising that of the numbers of excellent textbooks on the subject few are thoroughly read and understood by the layman who might otherwise have applied the information in practice. Nor is there any coordinated consultative system through which advice may be obtained not only for sight (as provided by the National Health Ophthalmic Service) but for the whole act of seeing, which includes consideration of environmental seeing conditions.

The illuminating engineer, work study engineer, architect and interior decorator are all engaged in a branch of seeing technology, and frequently their combined advice is necessary in addition to that of the ophthalmic practitioner. Because this is not generally realised, an individual, in guessing at the probable cause of his visual difficulties, consults one or other of the above practitioners in what he believes to be the most appropriate branch of seeing technology. Though usually obtaining some assistance he often fails to achieve maximum visual comfort and efficiency through having overlooked certain other factors which could also have been improved. Best seeing can rarely be attained by such a hit-and-miss approach. Seeing should be engineered.

Ideally there should be "Seeing Engineers" who are conversant with all the functional requirements of vision. After carrying out the necessary examination the "Seeing Engineer" would then present a complete specification for the individual's ocular and environmental visual needs at the given task in the form of a "Prescription for Seeing." The purpose of this article is to show something of what a prescription for seeing might contain, what factors the "Seeing Engineer" must consider in order to arrive at it, and also to show how the various branches of seeing technology are applied in relation to one another.

Seeing is a chain-like process which begins at the light source, continues to the object illuminated, enters into the eye and finally ends in the brain. The "links" are the physical characteristics of the visual field and the capabilities of the eye-brain (visual) mechanism. It is proverbial that "the chain is no stronger than its weakest link," and this very aptly applies to the seeing chain of an individual who, in attempting a given visual task, finds some of the links to be defective because they were just not designed for the job.

The whole act of seeing can be divided into the three sections:—

(1) The visual mechanism.
(2) The visual field.
(3) The illumination of the visual field.

In each section a knowledge of satisfactory conditions (as a standard for which to aim) and unsatisfactory conditions (for the quick recognition of deviations from that standard), together with methods of improving the latter, provides the basis for diagnosis and treatment.

The Visual Mechanism

It is an odd fact that when the visual mechanism is working satisfactorily the individual is unaware of his ocular blessings. He only thinks about his eyes when something is wrong. If, therefore, conditions are, or can be, arranged so that he is unaware of his ocular functioning it must be assumed that he is visually comfortable, and if he is able to perform his visual task quickly without lessening his comfort it must be assumed that he is also visually efficient.

As the pre-requisite for good seeing is a healthy visual mechanism the first step is to detect and refer for treatment any disease condition which may be present.

In health the normal eye has a number of functions. It receives an accurately focused image of a distant object at the back of the eye on its light-sensitive retina. When a near object is viewed the lens within the eye accommodates (increases its power) to maintain a clear image. The six external muscles rotate the eye so that the retinal image falls on the foveal area for viewing

critical detail. Owing to their separation the two eyes obtain slightly dissimilar images of the object viewed which the brain fuses into one stereoscopic picture revealing the third dimension, depth. Whether operating under high daylight, lower artificial or even starlight levels of illumination the eyes adapt their range of sensitivity in order to respond comfortably and effectively at all times. The colour sense permits accurate discrimination of colours at all but very low levels of illumination.

Though healthy, the various functions can be prevented from operating satisfactorily either by defects within the eye or of the external field of view.

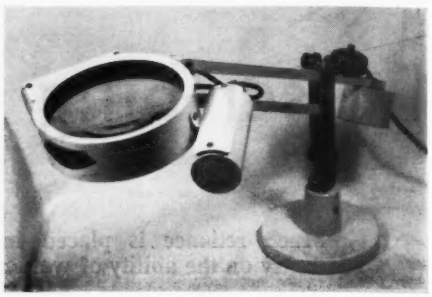


Fig. 1. Illuminated bench magnifier.

Refractive defects

The ocular refractive errors, myopia, hypermetropia, and astigmatism, can prevent the formation of a clear retinal image. With myopia, near objects are seen clearly though distant objects are blurred due to the image being brought to a focus short of the retina. Any attempt to correct the defect by accommodating would shorten the focus still more and increase the defect. Thus the myopic eye is unable to compensate for the blurred image of a distant object.

In hypermetropia the image is virtually focused behind the retina. On looking at a distant object the hypermetropic eye automatically pulls the image forward on to the retina. If the object is near to the eye a still greater effort of accommodation is required to keep the image in focus. Unlike myopia, the eye is therefore able to compensate for this defect for all object positions. However, the clear vision achieved, far from being a sign of ocular perfection, conceals a fatigue-producing strain. If the defect is great, or if the person is approaching middle age when accommodation becomes less flexible (presbyopia), the eye may be unable to correct the defect and the object then appears blurred.

It is this same presbyopia which prevents an hitherto normal sighted person from focusing his eyes for near-vision in later life.

Astigmatism causes a distortion of the retinal image which the eye is unable to correct.

The detection and precise measurement of these refractive errors is determined by an examination of each eye, and after weighing the type and magnitude of the defect against the visual task requirements a prescription for corrective lenses can then be given.

An unfortunate limitation of these aids is that their focal power is fixed. When, therefore, a presbyopic person finds he is unable to readjust his focus for the varying points of regard presented by his visual task he may need two or even three different pairs of lenses to compensate for the deficiency according to his far, intermediate, and near vision requirements. For convenient "switching" from one focal power to another the lenses are sometimes dispensed in the two-sight bi-focal, or continuous vision tri-focal form.

A special problem affecting accommodation arises when a normal or corrected individual is engaged in prolonged near-vision inspection of small detail. To enlarge the size of the retinal image he will shorten the viewing distance. This results in excessive strain to his accommodation which can sometimes be relieved by special occupational spectacles. Alternatively, a magnifying device may be used to enlarge the apparent size of the object and so enable the viewing to be done at a more comfortable distance away from the eyes. (Fig. 1.)

It is interesting to note here that such a seemingly easy solution to a visual problem is not always acceptable. For example, invisible menders will often prefer to strain their eyes rather than use a magnifying aid. They wish to see the material "naturally" lest the fault be repaired with a textural difference for which they are unable to compensate. In certain inspection processes the magnification of unimportant defects may cause them to appear major faults with consequent rejection of useful material. The facilitation of these tasks must depend on the best of other means.

Muscle balance

The six external muscles which move each eye are normally well balanced so that the two eyes are correctly co-ordinated and directed towards the object viewed. Any gross lack of balance between the two eyes will result (squint) and the individual fails to obtain stereoscopic vision. Medical treatment, muscle training exercises (orthoptics) and spectacles may be necessary to restore the balance. In cases where there is only a latent tendency for one eye to deviate relative to the other orthoptics and spectacles may be sufficient treatment.

Once again viewing objects very near to the eyes can also impose a strain on the muscles which converge the eyes. Relief may be given, as for accommodation strain, by occupational spectacles to reduce the convergence effort, or by magnifying devices to enable viewing at a more comfortable range.

Adaptation

The ability of the eyes to differentiate between one part of an object and another or even to perceive the object at all against its background depends not so much upon the clarity and size of the retinal image, but upon the patchwork of brightness contrasts forming the image. These contrasts result from the different luminances (physical lightness and darkness) of the various parts of the object and general field of view. Whether the overall level of illumination is high sunlight or lower artificial light the luminances seem to the eye to have, within limits, a constant apparent brightness pattern. Thus the in a deviation of one or other eye away from the object appearance of a room under correct artificial illumination appears little different from when it is seen under a higher level of daylight illumination. The means by which the range of sensitivity of the eyes is adjusted to maintain

with comfort these relative brightnesses in the field of view whatever the absolute level of illumination, is known as adaptation.

If, however, any part of the field of view has a luminance above the range for which the eye is comfortably adapted it appears glaring. For example a car headlight may remain switched on unnoticed during daylight as the eye is adapted to a high level of illumination, though at night, with a low level of adaptation, the same lamp then appears glaring. Any part of the field below the sensitivity range tends to become invisible, as when trying to observe detail within deep shadow on a sunny day.

When prescribing for this function it is important that reflection factors (or in the case of light sources and luminaires—surface brightness) within the field of view be designed to fall within the estimated range of sensitivity for which the eyes are adapted. In the special case where an increase in contrast is required as between a dark grey object on a black background it can be achieved to some extent by adequately increasing the level of illumination. When this increase is effected by local lighting the general illumination should not be less than the square root of the illumination falling on the brighter area.

As the state of adaptation alters with the direction of gaze towards different luminances in the field of view, controlled conditions should be attempted for all directions of view.

Colour vision

The effective use of the colour sense depends upon the normality of the visual mechanism and on the spectral distribution of the incident light. The illumination must also be above a certain minimum level. There is no substitute to compensate for a deficiency in either "partner" when accurate colour discrimination is necessary. However, in the special case where colour is used as an indicator signal, the design can sometimes be rendered more effective by imparting a characteristic shape (e.g., square, circle, etc.) to the coloured area as an additional aid to recognition.

Pre-vocational examination of juveniles before they embark on a career may reveal unsuspected deficiencies of the colour sense which could later prove to be a disappointing handicap.

The Visual Field

The whole of the visual field consists of the actual task area, the immediate surrounds and the peripheral background. An analysis of the physical characteristics of these various parts is necessary in order to know precisely what is required to be seen and how it affects seeing. These factors are:—

(a) The size of critical detail; depends on the actual size of the detail, the distance from which it is viewed, and its orientation with reference to the line of sight (e.g., 10 point type can have an apparent detail size of, say, 7 point type both by viewing it at a distance or by viewing it at an obtuse angle).

(b) Surface characteristics; texture, brightness and brightness contrasts, colour and colour contrasts are noted both of the task area and of the surrounds. In the former case the material, being governed by the nature of the work, usually fixes these characteristics, though in the latter, control is frequently possible by careful choice of paint or other surface finishes.

(c) Modelling and Shadow; are necessary for revealing solidity of objects and their relative positions in space. Whether these factors are for revealing architectural features of a room or the minutest surface irregularities of a model casting, the spacial distribution of the incident light is all-important.

(d) Job Layout; though studied for manual facility, affects the visual performance, especially of the presbyope. As an example of this, the bifocal wearer doing counter work often has difficulty reading the scales which are above eye-level, as the normal position for the reading part of the bifocal is in the lower half of the lens. Job designing could frequently be much improved visually by co-operation between work-study engineers, machine designers, and opticians. As a larger proportion of older workers are being employed in industry their visual problems will increase, and urgent attention to this particular aspect can save much inefficiency later on.

(e) Hazards; from flying particles, dust, fumes, radiations, etc., are best controlled by reliable safeguards as

Fig. 2. Profile projector.

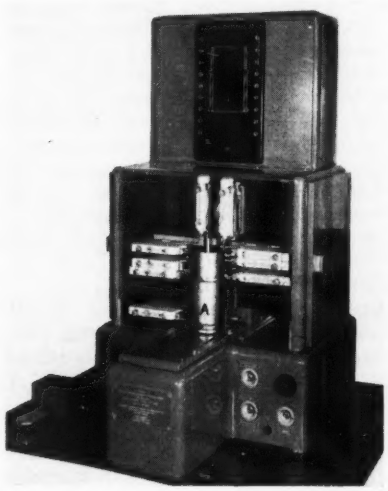


Fig. 3. Multi-dimension inspection machine.

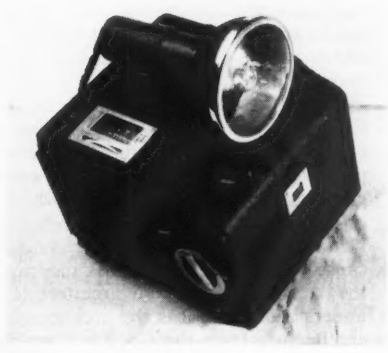


Fig. 4. Stroboscope.

part of the job layout and procedure. Goggles, shields, etc., also have their uses where the operative can be encouraged to wear them.

In general the visual task should be facilitated by any practical means, if necessary by completely transposing the nature of the task. Fig. 2 shows a projector which transposes the visual task from one of direct inspection of a small component to that of viewing a magnified profile on the screen. In Fig. 3 a multi-dimensional inspection machine takes several measurements at the same time, thus speeding and simplifying the original task of micrometer reading to one of reading the instrument panel. The stroboscope (Fig. 4) is an example of a special technique to render visible the revolving or reciprocating parts of a machine whilst in motion. To aid the partially sighted or blind person audible comparators are available to transpose visual measurements into aural information. (Fig. 5. See letter and further photograph.) Many more devices and methods are available for application where required: still others remain to be devised.

Illumination

Having discussed the visual functions and visual field characteristics it can now be seen what part light and lighting must play in order to link them all together. Thus, to render visible those objects in the field of view both with speed, comfort and accuracy, illuminating engineering must provide an adequate level of general illumination for overall field brightness; special levels of illumination to enhance brightness contrasts where necessary; adequate spectral distribution for colour discrimination; correct spacial distribution for modelling, shadow and texture, all with minimum glare.

The usual specifications for installation design provide the remaining constituents for a prescription for seeing, i.e., lamp type, wattage, number and positions, together with the appropriate luminaires.

Control of daylighting in interiors is the responsibility of the architect, though in effect a branch of illuminating engineering, and should form part of the general specifications of the lighting plan.

Conclusion

In providing visual tasks which are not designed with regard to seeing facility, a handicap is immediately placed on performance. To prescribe spectacles without prescribing correct lighting is incomplete advice for seeing. Conversely, to provide correct lighting without spectacles and other aids to vision, where necessary, is equally incomplete.

Treating the act of seeing as a whole would therefore seem to merit consideration on a basis of logic. Which will come first, the "Seeing Engineer" or the demand for such services, is at present something of a conundrum. However, when Prescribing for Seeing does become established practice another step forward will have been taken towards greater human comfort and productive capacity.

Acknowledgment is made to Alfred Herbert Ltd., Coventry, for providing the illustrations used in this article.

Correspondence

The I.E.S. Code

To the Editor, LIGHT AND LIGHTING.

Dear Sir,—The revised I.E.S. Code is much more comprehensive than its predecessor. It rightly brings forward the need for good quality lighting to first place and if for no other reason justified its issue. The inclusion of a section on daylighting is also commendable.

But, from an architect's point of view, the new Code is disappointing for two reasons.

First, it makes the whole subject of illumination seem more complicated than it really is and architects will tend not to read it. Perhaps it is not intended for architects; in which case it makes the second reason—that of the Code making no attempt to explain to lighting engineers the approach of a modern architect to design—even more pertinent. Both points are critical in this period of full building and development. Making the subject unnecessarily complicated will drive an architect either to ignore the engineer except on the occasions when he feels he dare not, or to throw the whole responsibility into the engineer's lap. Neither course is right. The second is particularly bad because the lighting engineer is just not capable of supplying the kind of answer the architect is after, even where he understands *what* it is the architect is after. Hence, to omit architecture from the Code is a serious neglect.

In these respects we are not really talking of the lighting engineer but of the lighting industry. Independent consultants in lighting are few and register little effect on progress. In other fields allied to architecture (notably structural engineering) independent consultants often set a cracking pace and provide architectural leadership, as in earlier periods. This is good because it provides impetus to good design.

The Code reiterates the plea "Early co-operation between architect and lighting engineer." This is fine but true co-operation is not yet possible because: (1) The lighting engineer seldom appreciates architectural objectives. (2) The lighting profession so complicate their subject that architects who have no time to spare for ploughing through pedantic literature (*viz.*, the Preface to the Code) live in relative ignorance and on their intuition and experience. (3) The lighting engineer is not able to give an independent judgment because he is largely a medium through which his firm's equipment is sold.

This is not a plea for more independent consultants, the architect or his client may not be able to support them. Rather it is an appeal to the industry to go out of their way to try to understand their customers' needs, offer sound advice—not just fittings out of a catalogue, or crude lighting schemes—and provide leadership in design so that the architect will be a willing customer. Or is this approach less profitable to the industry?—Yours, etc.,

Welwyn Garden City. JOHN BICKERDIKE.

Office Lighting

To the Editor, LIGHT AND LIGHTING

Dear Sir,—May one congratulate you on a particularly interesting number of the Journal? The two detailed articles on Office and Drawing-Office Lighting, followed by the further recent examples, form a most comprehensive review, and there are only one or two points which have not, perhaps, achieved sufficient prominence.

The first of these is the vertical plane of work at the front of the platen (i.e., roller) of the typewriter, and the second is the possibility of shadow from the higher forms

of office furniture and from certain special machines. These are two common factors which will possibly have considerable influence on the layout if a really satisfactory installation is to be obtained, particularly where the ceiling is low. A point that also requires consideration is the fact that the illumination on a vertical, or nearly vertical, drawing board is usually below that planned as the horizontal illumination, and an appropriate allowance will need to be made.

The "Herring-bone" layouts shown on pages 191 and 205 are interesting, and although they are highly praised it would seem that there is some danger of the fittings forming a distracting pattern, sometimes directly in the field of view.

Finally, Sir, a word on lighting terms—Lumeritas refers once more to the ancient feud between what the writer would be happy to term the "Footcandleers" and the "Lumens-per-square-footmen." Would it not be possible to come to an honorable truce by accepting, at one and the same time, "Lumens-per-square-foot" as the *unit* and "footcandle" as the *name of the unit*? "Footcandle" is still much the more readily spoken term and, through its long associations, universally understood.—Yours, etc.,

London. R. R. HOLMES.

Personal

The President-designate of the Association of Public Lighting Engineers, MR. J. M. WALDRAM, who is to be inducted at the Annual Conference at Folkestone (September 13-16), is for the first time in the history of the Association not a public lighting engineer, but is concerned with research and manufacture. MR. WALDRAM is the Senior Research Illuminating Engineer of The General Electric Co., Ltd., having joined the company in 1923 and transferred to the research laboratories in 1925. Much of his work has been devoted to street lighting, on which subject he has written a book and many papers, and has lectured in England, America and on the Continent. He is a Fellow and Past President of the Illuminating Engineering Society of England and a Fellow of the Illuminating Engineering Society of America.

MR. C. G. F. PRITCHETT, M.I.E.E., A.C.G.I., has taken over the position of chief engineer to Chloride Batteries, Ltd., Exide Works, Clifton Junction, Swinton, Manchester, in succession to the late MR. C. P. LOCKTON. Mr. Pritchett, who has been engaged in the battery industry since 1925, became a director of Chloride Batteries, Ltd., in May, 1952.

Thorn Electrical Industries, Limited, announce further changes in the sales organisation of the Atlas Lighting Division. MR. E. W. KING, former Area Sales Manager, Midlands Area, is being transferred to Head Office to work directly under the General Sales Manager on a special assignment in connection with large industrial users. Other changes include the division of the London Area into two parts with MR. R. S. GOWING as Area Sales Manager, London Area North, and MR. M. J. DONAGHY as Area Sales Manager, London Area South. MR. L. A. MOIR will assume responsibility for dealing with large wholesalers with Head Offices in the London Area.

Trade Literature

VERITYS, LTD., Brettenham House, Strand, London, W.C.2.—Catalogue of "Maxlume" fluorescent fittings, including a new range known as "Quick-Lock."

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, London, W.C.2.—(1) A bulletin entitled "Modern Streetlighting Practice," giving an up-to-date review of current British practice in streetlighting, including lantern optical design, economics, recommendations, specifications and codes of practice. (2) 1955 lamp catalogue listing 1,500 types of lamps in groups. Also lamps and fittings broadsheet. (3) "Mazda" lighting equipment catalogue, pocket edition (March, 1955). Listing all fluorescent, commercial, industrial, streetlighting and floodlighting fittings and control gear with prices.

COURTNEY, POPE (ELECTRICAL) LTD., Amhurst Park Works, Tottenham, N.15.—Catalogue showing extensive selection of fluorescent and tungsten lamp fittings.

TUCKER & EDGAR, Berkeley Works, Berkley Road, N.W.1.—Leaflets and price lists of decorative tungsten lamp fittings.

TROUGHTON & YOUNG (LIGHTING) LTD., 143, Knightsbridge, S.W.1.—(1) Catalogue of "Ultralux," "Versalite," and "Mondolite" tungsten lamp fittings including price list. (2) Leaflet illustrating new range of "Tubalux" fluorescent lighting fittings for commercial and industrial use.

CRYSELCO LTD., Kempston Works, Bedford.—Leaflet on opal glassware commercial fittings giving prices.

J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall, Staffs.—Brochure entitled "For the contemporary interior" describing Crabtree matched range of wiring accessories.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Brochure, with prices, on "Osram" fluorescent lamps.

THE PLESSEY COMPANY LTD., Ilford, Essex.—Book on the Plessey organisation.

SIMON HYDRAULIC MACHINERY, Queen's Cross, Dudley.—Illustrated leaflet introducing the "Simon Hydraulic Platform," a machine quite new to this country.

Situations Vacant

Well-known manufacturers have a vacancy for a YOUNG MAN to plan, and ultimately take charge of, a section manufacturing discharge lamp control gear. Practical experience of design and/or production of this similar equipment essential. Excellent conditions of employment and social facilities.—Apply, giving details of age, training, experience, etc., to Box No. 899.

SENIOR LIGHTING DEVELOPMENT ENGINEER wanted for factory in the North Midlands. Age preferably between 30 and 35. Applicants should possess a degree in physics or engineering, or higher national certificate, and should be experienced in the design and development of lighting equipment. Good salary and excellent prospects. When replying please give full details of age, education, technical experience and salary required. Our own staff have been informed of this vacancy.—Apply Box No. 900.

A leading firm in the lighting industry has a vacancy for a first-class DESIGNER in its lighting department. Work will be concerned with special decorative fittings designs in both contemporary and traditional styles, and new lighting developments. The post offers attractive prospects and salary for man with initiative, imagination, and a sound experience in this field. Apply in writing, quoting Ref. D.O., to the Staff Manager, The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

The British Thomson-Houston Company, Ltd., have a vacancy in their research laboratory at Rugby for a qualified PHYSICIST or ENGINEER for radiation measurements in a lamp development group. The work is varied and interesting, and offers scope for development of new techniques. Applicants are invited to send particulars of their age and qualifications to the Director of Research, British Thomson-Houston Co., Ltd, Rugby, quoting reference RM.

Crompton Parkinson, Limited, require in the London Area JUNIOR LIGHTING ENGINEERS and LIGHTING SALES ENGINEERS, the former capable of planning industrial and commercial layouts under supervision, the latter able to deal with users' inquiries and to prepare surveys and to sell. Please write, stating salary required, experience, etc., to MD/P2, Crompton House, Aldwych, London, W.C.2.

LIGHTING ENGINEERS required London Office Technical Department for preparation of lighting schemes. Write stating qualifications and salary to Manager, Technical Department, Falks, 91, Farringdon Road, E.C.1.

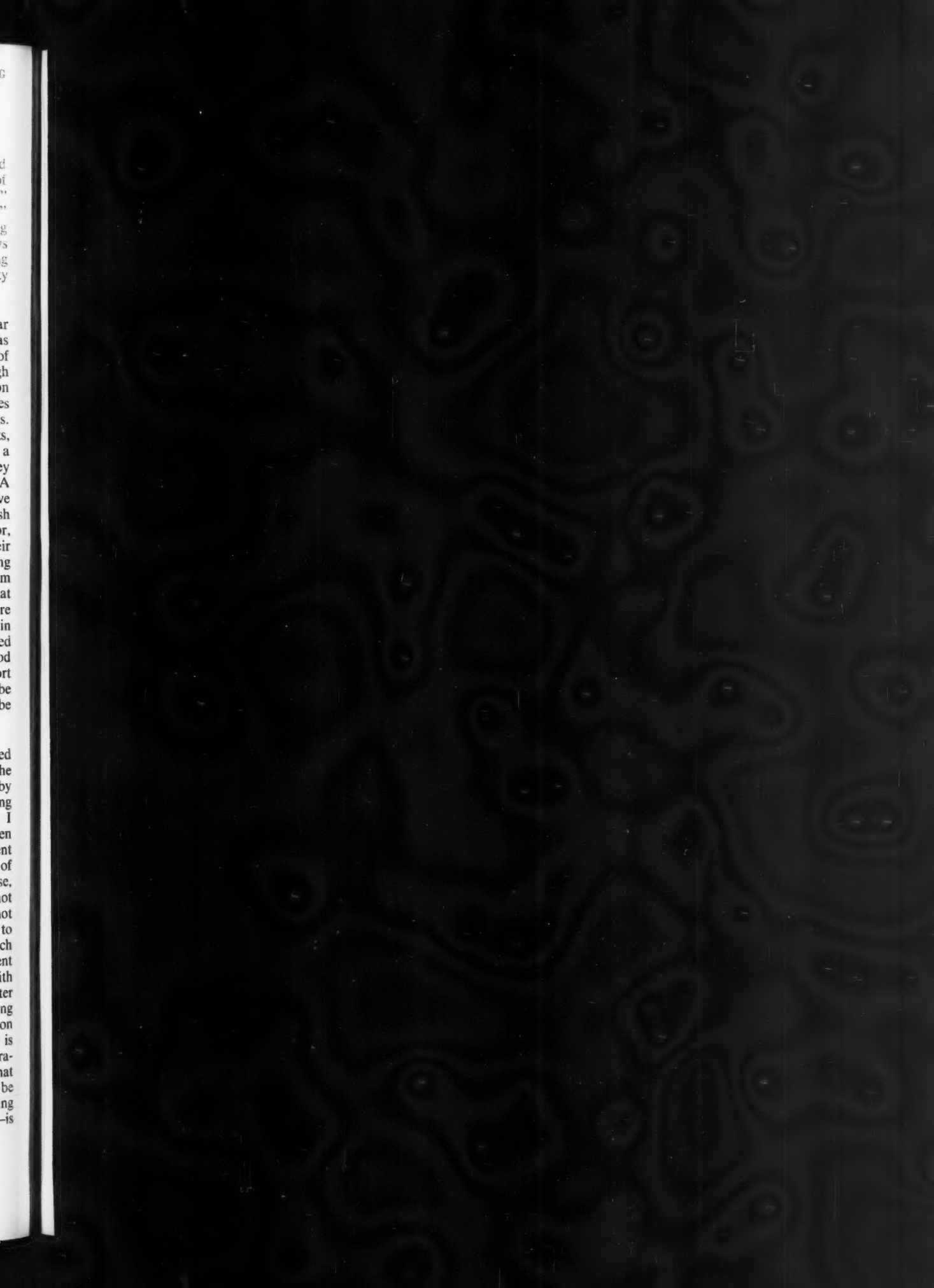
Situation Wanted

Registered Lighting Engineer seeks REPRESENTATIVE post with progressive company in London Area. Young, enthusiastic, imaginative. Wide planning and sales experience extending over eight years. Excellent lighting qualifications. Box No. 901.

POSTSCRIPT By "Lumeritas"

Good advice upon lighting does not come exclusively from specialist lighting designers. This remark is prompted by my perusal of an article written by the managing director of a bookselling company for "The Design of a Bookshop." This article included sections dealing with lighting and with the use of colour, and the author's suggestions for the lighting of a bookshop showed a knowledge of appropriate techniques which—fortunately for the lighting "engineers"—is not general among "users." Among the author's remarks, I would underline these—"There is nothing more boring or characterless than theoretically perfect, eyestrain-free lighting evenly distributed throughout the shop. It is by the use of shadow as well as high-lighting that one obtains interesting contrasts and warmth and gaiety." This reminded me of what was said by the sensory physiologist, Dr. R. J. Lythgoe, in a paper on "Visual Perceptions under Modern Conditions" which appeared in the first issue of the I.E.S. Transactions [Trans. I.E.S. (Lond.), **1**, 3, 1936] viz.: "A blameless installation of artificial light is apt to appear dull; not only does the lighting seem featureless, but it also appears to be of too low an intensity." Now here, both the authority on the physiology of vision and the discerning lighting user agree in finding the same fault with that kind of lighting which, respectively, they understand to be thought "blameless" and "theoretically perfect." Obviously such lighting is not perfect and not blameless since it is psychologically unsatisfactory. "Even distribution" and "brightness uniformity" have, in the recent past, been over extolled, but in current concepts of good lighting a better balance is struck between psychological and physiological considerations. Discomfort and "pleasantness" due to lighting—both of them within the sphere of the psychology of "feeling"—are subjects recommended by the International Illumination Commission at Zurich for active study. I suggest that the pleasantness of artificial lighting may be enhanced by variability. One of the accepted principles of ventilation is variable rather than uniform air-movement, since this is stimulating whereas uniformity is not. All the sensations evoked by our environment are due to *changes* of the stimuli we receive from it. We get changes of visual stimuli by merely looking round us, but if we have to spend long periods in a room with ordinary *static* artificial lighting do we find such lighting so pleasant as subtly varying daylighting? The answer is no so far as I am concerned: if I could have it, I think I would find suitably variable artificial lighting as pleasant as suitably variable air-movement.

Looking through the London "Daily Telegraph" (which is celebrating its centenary) the other day I noticed a paragraph by "Peterborough" headed "Spreading Light." Half expecting an allusion to the I.E.S.—whose motto *passim spargere lucem* means "to spread light everywhere"—I read on. However, the paragraph referred to a pre-I.E.S. spreading of light as the following quotation shows: "In its 100 years of life the 'Daily Telegraph' has always tried to spread light. Once, I discover, it did so literally. Among letters of congratulation on the centenary has come this extract from the Press Club records of last century: 'The Committee have much pleasure in announcing that Sir Edward Lawson has most generously promised to supply, free of charge, from the machinery of the "Daily Telegraph," the current necessary to light the Club by electricity.'" As "Peterborough" adds, the legality of this proceeding may have been questionable at the time, and nowadays I suppose a gift of light can be made only by arranging to foot the bill rendered to the beneficiary by the electricity supply authority.

My comment last month upon flashing-light car direction indicators has been echoed elsewhere. It has been reported in the daily Press that the Association of Municipal Corporations, which represents 425 borough councils throughout Britain, is to ask for the prohibition of these lights. Apparently a majority of chief constables and police authorities are strongly against the lights. There seems to be a widely held view that flashing lights, including the "blushing ears" on taxi-cabs, are a distraction rather than a safety measure and that they are not fitted where they can be clear to other traffic. A new journal called "Motoring News" claims to have made a survey which reveals that 80 per cent. of British motorists dislike the flashing-type direction indicator, while few of the other 20 per cent. like them in their present form on most cars. Apparently the motoring organisations have also received complaints from members about these lights and the point is stressed that their efficiency depends very largely on where they are placed. Flashing-light direction indicators have been in use far longer in other countries, such as the United States, than in Britain, and no doubt there is a good case for fitting them to British cars intended for export to these countries. I do not think their use is likely to be banned in this country but I am sure that they should be more effectively located.

In one of the series of television programmes entitled "Harding Finds Out," Sir Hugh Casson condemned the disfigurement of a certain part of the city of Hereford by the erection of "gallows-like" fluorescent street lighting standards. I am bound to say that in this instance I felt the condemnation was justified. There have been many adverse criticisms of "lamp-posts" in recent months, notwithstanding the approval given to some of the offenders by the Fine Arts Commission. Of course, a design that is inoffensive in one environment may not be so in another, and with 300 odd (the last word is not used with a double meaning!) designs from which to choose it should have been possible to select one which would have "fitted" Hereford better. In a recent Continental tour I saw several types of lamp-posts with fluorescent lamps which seemed to me to be in better taste than that shown by some of our municipal lighting authorities. Speaking of Gilbert Harding, my attention has been drawn to a paragraph in his Notebook which is featured by a certain pictorial weekly. From this paragraph I quote "Mr. Lighting Engineer (what does that word mean?)" I doubt if any lighting engineer will be unduly downcast by Mr. Harding's ignorance concerning this brand of engineer, but has he got a point here—is "engineer" the right word?